THE MODEL ENGINEER

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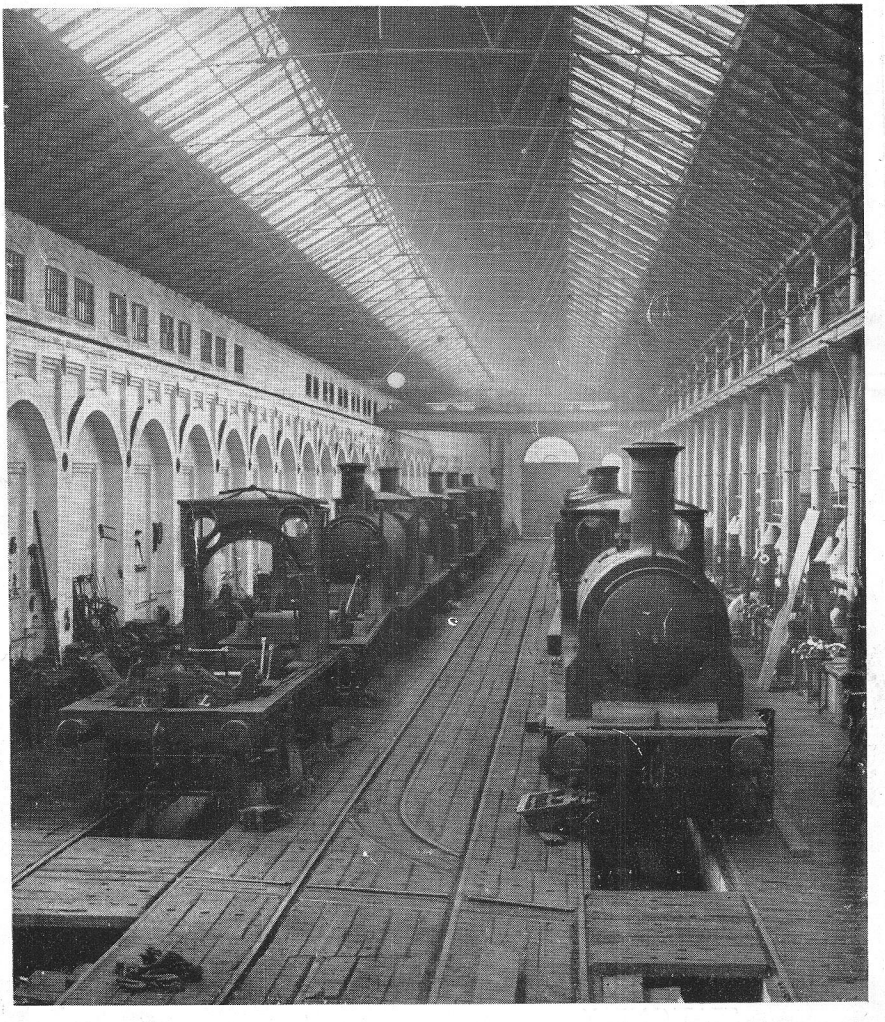

A Locomotive "Hospital" in the old days.

This interesting view of the erecting shop at the Brighton Works of the old L.B.&S.C.R. was submitted by Mr. F. S. Lovick Johnson, who was serving his articles there at the time, about 1897, *when the photograph was taken*

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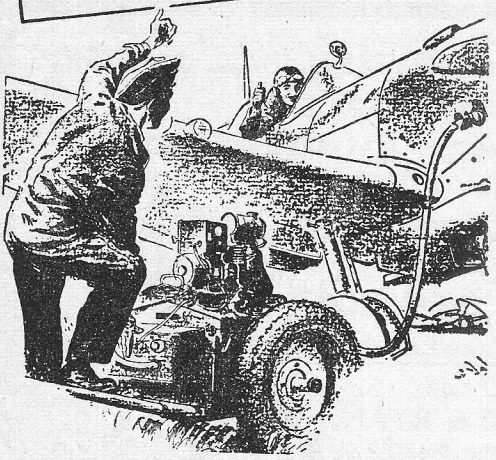

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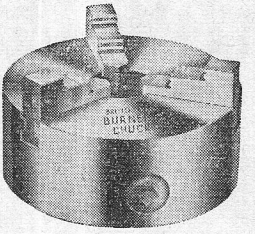

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THE
MODEL ENGINEER

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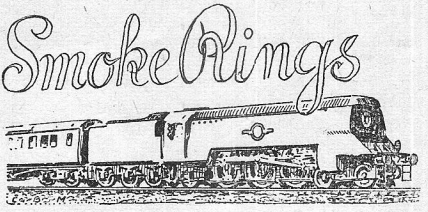
VOL. 95. No. 2380 DECEMBER 19th, 1946

Smoke Rings



The "M.E." Goes Ahead

WHILE walking out with a friend the other day he dived into a tobacconist's shop to re-fill his pouch. When he emerged he said, "I have just paid 2s. 10d. for some tobacco I used to get for 10d. in the old days." "Was there any more tobacco in the packet?" I asked. He grinned, and said: "Not likely, just the same old ounce." If I went to my tailor to get a much needed new suit I know quite well he would charge me three times the price I used to pay. I read in my morning paper that my daily journey to the office is going to cost me more, and when I get to my desk I find a message from our printing manager that charges for ink, paper, wages and everything else are mounting so rapidly that his bill for printing THE MODEL ENGINEER is of necessity going to be substantially increased. To add to this cheerful picture the process engravers who make the blocks for our illustrations write in to say that despite recent advances in their rates, the cost of blocks is to be increased by another 33 1/3 per cent. I won't bore you by elaborating this doleful tale; you know as well as I do from your own personal shopping experiences, and from the costs in your own business that we are all caught in a spiral of ascending prices from which there is no escape if we are to maintain the quality of our products and the efficiency of our service. How will this affect THE MODEL ENGINEER? Let me break the news gently; it will cost you more. As from the issue of January 2nd, your weekly copy will cost you 9d., instead of 6d. There is, however, a ray of sunshine breaking through the clouds, it will be a better MODEL ENGINEER, with an increased number of pages, another eight in all, to enable us to deal more helpfully and more effectively with the rapidly growing activities of the model engineering world. You will, in fact, enjoy your hobby more with the fuller service we shall be able to give you, and you will feel still more truly a member of that remarkable M.E. brotherhood which is so firmly rooted in the application of our world-wide reader-public. THE MODEL ENGINEER as a journal is unique; it will continue to be so, and will, I am sure, long maintain its friendly relationship with the thousands of talented and enthusiastic folk who, in their appreciation, sum it up in that all-embracing word "ours." Yes, my readers, it is truly "yours" in its devotion to your interests and welfare in your leisure hours. When you get your new copy you will not, like my tobacco buying friend, just get "the same old ounce," but a liberal extra measure of the good things which mean so much to your progress and powers of pleasurable achievement in your workshop. Just a word of assurance to our present subscribers—all current subscrip.ions on our books will be completed at the old rate. Renewals, when they become due, and all new subscriptions received after to-day's date, will be at the new rate of £2 2s. per annum, post free.

My Christmas Greeting

ONCE again, for the forty-eighth consecutive year, I extend to you all my warmest good wishes for the Christmas Season. May it hold for you in full measure good health, good cheer, and peace of mind. I know of no community where the spirit of good will flourishes more sturdily than among model engineers, so whether you are a "lone hand" or a member of a live Society, let my personal good wishes add one more seasonable touch to that bond of brotherhood of which we are all so rightly proud.

Next Week's "M.E."

OWING to the Christmas Holidays, next week's issue of THE MODEL ENGINEER will be dispatched to subscribers and the trade on Tuesday instead of Wednesday. It may be anticipated that copies sent by post will be subject to the usual postal delays at this season.

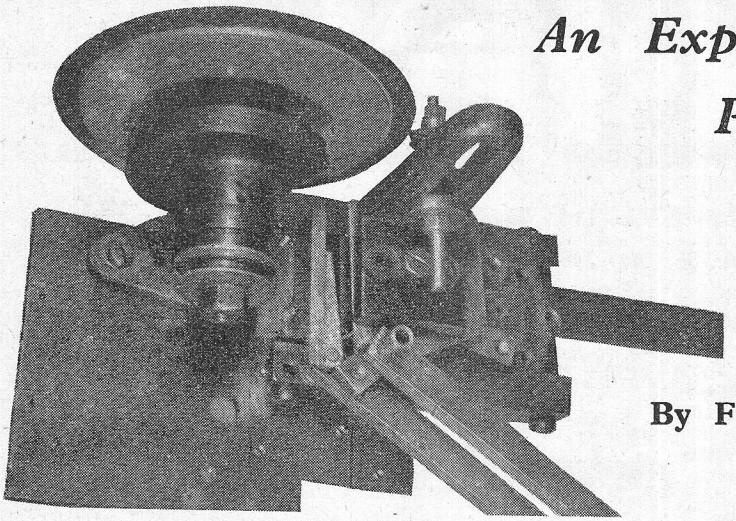
News from Rugby

THE Rugby Model Railway and Engineering Society has resumed its activities lately. The construction of multi-gauge track for passenger hauling is well under way and will take 2½-in., 3½-in., and 5-in. gauge locomotives. But the Society's chief need, at present, is more members; there must be several potential members in Rugby, and, to locomotive enthusiasts especially, the availability of a track should be tempting. Interested readers are invited to get into touch with the hon. secretary, Mr. W. S. Ross, 30, Regent Place, Rugby.

Percival Marshall

An Experimental Profile Grinder

By F. W. Waterton



Close-up of cutter and supports

THE grinder described below was made to provide suitable cutters for the purpose of milling spur gears for models and small mechanisms. Various schemes have been tried for developing an involute curve in the lathe to give the correct profile to the teeth of the milling cutter, but these all left a great deal to be desired. The cutter was circular in form and the cutting edges not relieved. The present scheme not only developes the correct profile, but also backs off the cutting edge in the same operation.

The method used in this arrangement is to draw out the tooth form required at a scale of about twenty times full size, and use the profile obtained as a template for a pantograph which reproduces the profile at the required size. The pantograph is used to control in turn the motion of a link and slide mechanism on which is mounted the cutter blank. The cutter is ground to shape by holding it by means of the pantograph against a revolving emery wheel. The link and slide mechanism (see diagram) was introduced to provide a platform on which the cutter could be mounted, and which would reproduce faithfully the motion of the control point on the pantograph. The template was cut from $\frac{1}{16}$-in. sheet metal so that the follower of the mechanism could be held against the edge when following out the shape. This was found to be superior to and simpler than attempting to follow a line drawing with a stylus, as the reaction from the cut was taken on the template and any slight stiffness in the link mechanism did not affect the accuracy of the reproduction, and also left the operator free to observe the work.

The links of the pantograph mechanism were made from $\frac{1}{2}$-in. × $\frac{3}{8}$-in. bright steel bar, and were pivoted on $\frac{1}{4}$-in. diameter silver-steel pins. The centres of the link mechanism were marked out on a master link, drilled and reamed, and the remaining links drilled, using this link as a template. The holes were then lapped out. No particular care was taken to obtain any exact link ratio (see F D/E D in diagram), as it was considered easier to measure the link centres after drilling and multiply the profile dimensions by the ratio obtained from these measurements. The pins were rubbed down until they were a light tap-fit in the holes in the links, and the ends hollowed and riveted over into a slight countersink on the holes in the links until no appreciable endplay was present. The pin centres were measured, the short link centres (D E, B C) by micrometer over the pins and the long link (D F) by ruler and the reduction factor of the linkage worked out; it came out at 23.5/1. This was checked after final assembly by moving one end of the pantograph (F in diagram) a given distance and measuring the distance moved by the cutter blank by a dial gauge. A small cross-slide which was once part of my lathe was then pressed into service, the lead screw removed and the carriage fitted with the king pin (A) of the pantograph. To make the king pin more rigid the top end was supported in a bracket bolted to the carriage.

A combined link and mounting plate (B G H) for the cutter was made from a piece of $\frac{1}{4}$-in. × 2-in. bright steel, and this was drilled and reamed for the control pivot pin (B) of the pantograph linkage.

The plate was mounted from the moving portion of the slide by means of two links (KG, IH) in such a position that the links made an angle of about 30 degrees to the ways of the slide with the long link of the pantograph in mid-position. In this way any object or point on this plate (B HG) faithfully reproduced the motion of the follower on the pantograph without any superimposed rotational movements at a scale reduction of 23.5/1. A slotted angle-bracket (part of the lathe equipment) was pressed into service as a mounting bracket for the cutter blank. The grinding spindle (another lathe accessory) was modified slightly to take a 6-in. diameter by $\frac{1}{16}$-in. wide emery wheel.

A start was then made on drawing out the tooth profiles required on paper 23.5 times full

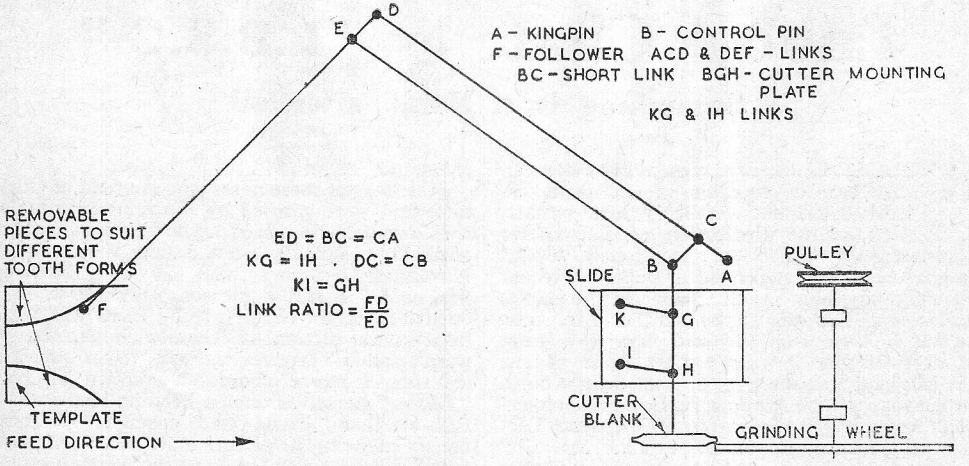
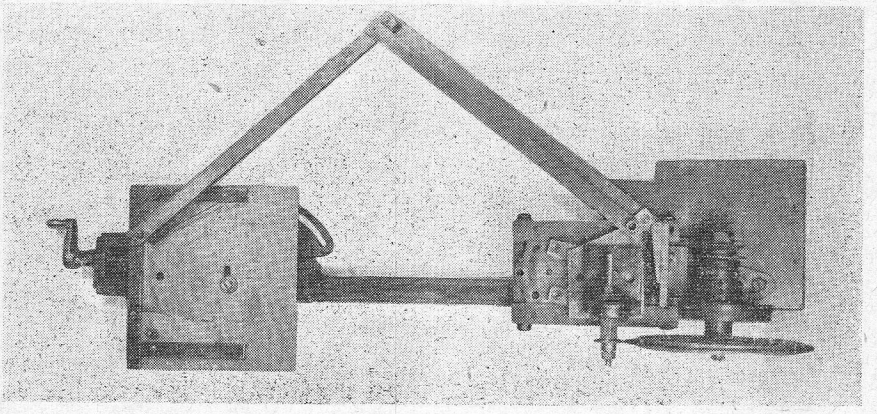


Diagram of mechanism

size. The particular gears required were 18, 24, and 48 teeth, 40 D.P. of involute form. A milling cutter thickness of $\frac{1}{8}$ in. was standardised to simplify the template, also a piece of $\frac{1}{8}$-in. tool steel was available from which to cut the blanks. A grinding wheel was obtained and mounted on the grinding spindle and dressed to a rectangular profile by means of a tungsten carbide chip held on the angle-bracket in place of the cutter blank. The thickness of the wheel was measured with a micrometer after dressing.

The follower (F) at the end of the pantograph mechanism was made from a piece of the same silver steel as the pivot pins ($\frac{1}{4}$-in. diameter) as a hole in the end of the link was already there from the drilling of the links. The width of the parallel sides of the template could then be calculated as follows: and were equal to 23.5 × (width of cutter + width of grinding wheel) + $\frac{1}{4}$ in. A rectangular frame was then made with the above inside dimensions. It remained to make three pairs of profile pieces to fit in the corners of the rectangle, each pair representing the profile of a cutter. The form which remained then represented the profile of the cutters, 23.5 times full size increased in width by 23.5 times the thickness of the grinding wheel, plus $\frac{1}{4}$ in. for the follower pin. The cutter blanks were then cut from the $\frac{1}{8}$-in. tool steel and mounted on a mandrel in the lathe and turned roughly to shape. The cutters were mounted on the dividing head and the cutter teeth notched out. This ensured the cutter teeth would be evenly spaced. The blanks were then mounted on the mandrel on the angle-bracket of the pantograph mechanism. The template was mounted on the top slide of my compound rest borrowed from the lathe for the occasion. The cutter mounting bracket,



Plan view of complete mechanism

the ways of the top slide, and the side of the template were then all lined up parallel to the grinding-wheel face. The cutter blank was set up with its cutting edge about $\frac{1}{4}$ in. above the horizontal centre line of the grinding wheel and the profile rough ground. The cutter was then hardened and finish ground. The setting of the cutting face above the centre line of the

(*Continued on page* 608)

Lobby Chat by "L.B.S.C."

Something in a Name after all

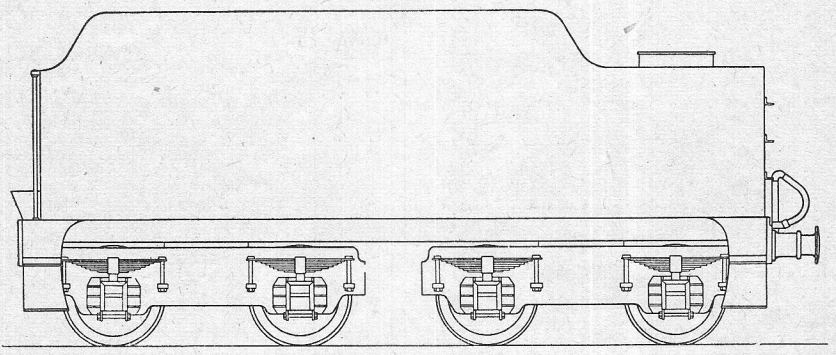
REGULAR followers of these notes will recall that I made mention of the paper on L.M.S. locomotive history read by Mr. E. S. Cox at the Institution of Locomotive Engineers, in which he mentioned several designs that had never been built. Without knowing anything at all about this, a Notts reader who happens to be another Mr. Cox, to wit, P.J. of that ilk, and who is a great admirer of the Fowler engines both of the old Midland and the present L.M.S., got out a design for a 4-6-2 incorporating Fowler characteristics, and started to build it in 3½-in. gauge. That is a coincidence, if you like! This Mr. Cox kindly forwarded a drawing of his "Fowler ghost," and here you see it. Though bearing outward resemblance to the unbuilt Fowler design, the works are very different; for, whereas Sir Henry Fowler's design was a four-cylinder compound, Mr. Cox's engine is a three-cylinder simple, on the lines of the "Royal Scot." Anyway, the construction is well in hand, and your humble servant, for one, will be highly interested in the realisation of a "might-have-been." I hope Mr. Cox will be able to forward a picture and further details as the job progresses. Incidentally, it is the fifth in the "running shed," the others being a 4-4-0 compound, 4-4-4 tank, 4-6-0 "Royal Scot," and Hughes-Fowler 2-6-0 (forerunner of "Princess Marina"), all 3½-in. gauge. Mr. Cox says when the Pacific is finished, he hopes to start on the "Princess of Wales" Midland single-wheeler, which he considers the most beautiful locomotive ever built. She certainly was in the front line of "locomotive lovelies," and should prove very efficient in 3½-in. gauge.

As there is another Mr. Cox building a 5½-in. gauge "tailwagger," and several others of the same surname have written on various locomotive topics, I shouldn't be at all surprised to receive a photograph of a L.N.E.R. 2-6-2 bearing the nameplate "Bantam Cox"!

Personal Memos.

Followers of these notes who are fond of Curly tales and were amused by my reminiscences of the Greenwich branch of the old London Chatham and Dover Railway, should take a look at the November-December issue of *The Railway Magazine*. I had a pleasant surprise when I opened mine, for the first thing I saw was a fine frontispiece picture of Greenwich Station (it wasn't called "Greenwich Park" then) taken at the time I wrote about. To crown all, old "Mona" herself is shown heading the train of four-wheeled "cattle-box" coaches. As there are six of them, the picture must have been taken on a Saturday, when there was more traffic, owing to the "rough people" my Victorian would-be protector was so afraid of. In fact, the golden-haired kid, and the lady who thought she was talking to a shy girl, might be on the other side of "Mona's" boiler! It is an excellent picture of the engine; you can plainly see the resemblance to Archie Sturrock's engines of similar type on the Great Northern. There is the "half-mile gap" between the driving wheels and the radial axle, the domeless boiler with a big brass casing over the safety-valves, and the bent-over weather-board-cum-cab that I mentioned in connection with "Mona's" sister "Erin." It had to be cut away just above the side fender, to let the reversing-lever pass, making a little extra draught for the driver when running chimney first, and a wet arm when raining.

Children get hold of some quaint notions. Young Curly liked "Mona" and "Erin" much better than the Martley tanks, because they had the coupled wheels in front, like his beloved Brighton "D" class tanks, and the rods ran direct on the wheel bosses, not on separate cranks; but the grey matter under the golden mop was forever puzzling out the whys and wherefores. Why couldn't the trailing wheels have been set farther forward and the tanks put at each side of the boiler, which he thought should have had a dome



The tender for Mr. Cox's engine

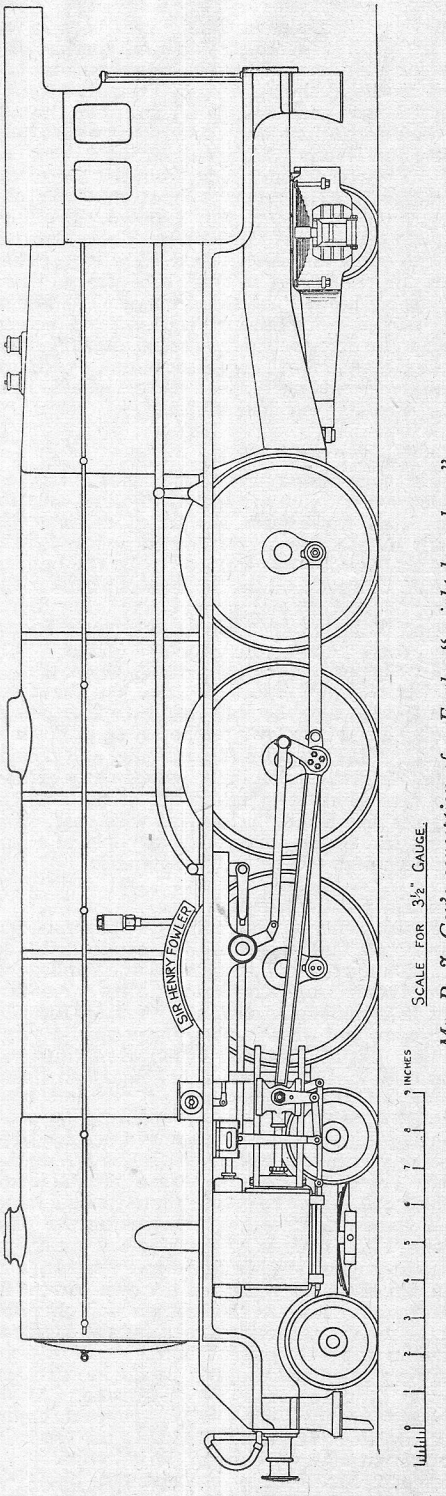
in the middle, with a pair of spring-balances on it. The only reason he could think of was maybe they were intended to be tender engines with small driving wheels, like " Lyons " and " Turin " on the Brighton line, but perhaps the builders had run out of material (like Curly himself did!) and had only enough to make a little short tender with one pair of wheels under it. But, anyway, why did they want such a comparatively big engine at all, when the darling little Brighton " Terriers " could pull one more carriage easily up and down the heavy grades of the East London line and twice the number on the South London? Curly puzzled and puzzled, and finally gave it up as a bad job. Happy days!

Anybody interested in old-time tank engines might do worse than build a 3½-in. gauge copy of " Mona " or " Erin." As I mentioned in the reminiscences, the last time I saw my old friend Steve Knight alive, we yarned about the old Greenwich branch; and I had in mind to build him, as a surprise leg-pull, a gauge 1 " Erin " with a single cylinder and spirit-fired boiler, for his workshop line.

May I thank those several readers who wrote me direct concerning the little railway at Riddlesdown, especially those who sent photographs of the permanent line that was installed in after years. The date of my ramble, as near as I can remember by associating it with other happenings, was the Whitsun of 1889, and I don't think the permanent line had been put down at that time. The one I wrote about was, as stated, a portable affair belonging to the travelling show, which was quite a big outfit, including steam roundabouts, swings, shooting-gallery, coconut shy, menagerie and circus. I have tried hard to recall the name, but it has gone, I am afraid, for ever. The only resemblance between the engine I saw, and the permanent one, was the straight stovepipe chimney; the latter was a tank engine with an open-backed cab and much smaller driving wheels with curved spokes. The gauge was about twice the width of the portable one. The carriages forming its train were provided with awnings.

Though I have been living for the past sixteen years within fairly easy walking distance of Riddlesdown, I have never been up there during that time. The business of earning a living and what is popularly known as " one darned thing after another," not to mention the interlude by Adolf & Co., has very severely limited my chances of a little recreation; but if we get any fine weather next spring and I am able to do it, old Curly hopes to spend a couple of hours one afternoon " on childhood's trail," and maybe find at least the site, if nothing else, of the permanent railway mentioned by my correspondents.

Do any of our older readers know what became of the " Channel Tunnel Railway " that was a popular feature every year at the old World's Fair at the Agricultural Hall, Islington? The track was a complete circle, laid on the floor in the hall. Right across the middle was a canvas screen, painted to represent the Channel, with cliffs, ships, small boats, seagulls and other impedimenta, the railway running through two openings painted around to represent tunnel mouths in the cliffs. The engine was—with the



Mr. P. J. Cox's conception of a Fowler " might-have-been "

possible exception of the Southern "queer ones"!—the quaintest thing I ever saw. It was a 2-2-2 single-wheeler, with steeply-inclined outside cylinders having the valves on top, and they looked as though they had been taken off a steam launch and hung up haphazard on the side of the boiler, which was a small affair with a huge dome and chimney, the latter having a brass bell top. The steam pipes came from the top of the dome, outside the boiler, to the steam chests, and were polished copper, fully exposed. The most curious feature was the wheels. Those that ran on the outer rail of the circle were bigger than those on the inside, so that there was no wheel slip going around the sharp curve. The engine was named "Sir Edward Watkin"; I believe it was once described in the *Locomotive Magazine*. Coke was used for firing on account of the engine running "indoors," and smoke would have caused trouble with the authorities.

A "Lassie" of the City

The reproduced photographs of a "Lassie" under construction are remarkable, not only for the detail work—note the fluted motion-rods, castle nuts and other refinements—but for the fact that the job was carried out by the builder, Mr. A. C. Spong, on the top floor of a bank in the heart of the City of London! She is the fourth engine built by our worthy and elevated friend, the others being "Sir Morris" (gauge "O") and "Dyak" and "Olympiade" (2½-in. gauge), so Mr. Spong's efforts operate on the Coué system. He says the only chance he ever gets of having a run is to lay a temporary track down in a passage below, when it is all quiet and nobody about, and wishes he had a railway in a garden, but gets plenty of pleasure out of building the engines and has to be content with that. Well done, Mr. Spong, and may your hopes of a long garden railway eventually materialise!

Britain DID Make It!

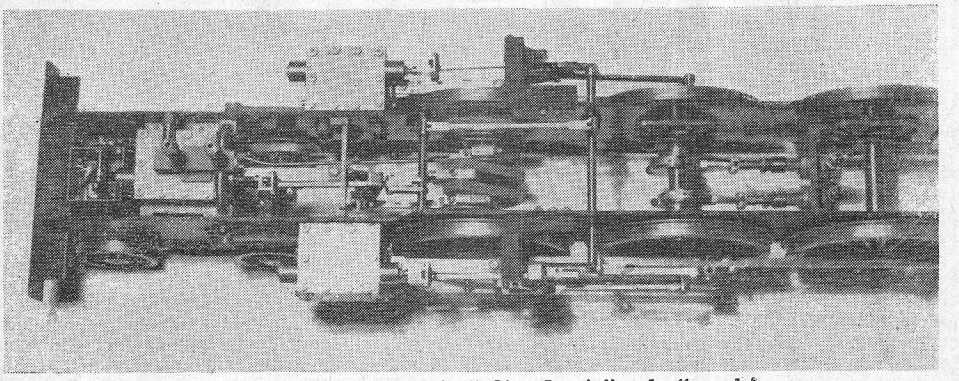
Readers who use a lathe for other purposes than locomotive building, as well as regular followers of these notes, may be interested in the following. As old readers know, my old workshop at Norbury was an upstairs room, originally intended for spare bedroom, and wasn't much bigger than a ship's cabin. Up to 1923, my principal machine-tool was a 3½-in. Drummond lathe, but I had always hankered after something heavier and more powerful, being precluded from installing a big 5-in. or 6-in. lathe on account of space available, and respect for the ceiling of the living-room below. Power drive was also taboo, for the reason that it would have been difficult to fix up a motor and countershaft without "knocking the place about," in a manner of speaking; it wasn't my own house, and the landlord was a bit particular. On top of that, I generated my own current for lighting, at one-third the cost per unit obtaining in the district at that time, running the engine on paraffin and water, and charging a set of train-lighting accumulators (they *would* be that, says you!) by aid of a 750-watt dynamo. As my voltage was only 25, it would have meant running the engine every time I wanted to use the lathe, to prevent a heavy drain on the batteries.

When Mr. Milnes brought out his 3¾-in. type R and I read the specification, I thought it was the "answer to my prayer," and ordered one; but there was one item in the specification I didn't care for, and that was the roller-bearing mandrel. Mr. Milnes sent me a personal letter on this subject, saying that, if I didn't find the roller bearings satisfactory, he would change them for plain ones. Well, to cut a long story short, as Mr. Gubbins's "Man in a Pub" would remark, the work came off covered with minute lines, after three weeks of use. I sent Mr. Milnes some samples of work, and he agreed that the marks were caused by the roller bearings; he had the headstock back, and replaced the front bearing by a cone 2¼ in. diameter, leaving the tail roller in. Another three weeks went by, and then spirals appeared on faced work, plus some irregular markings on ordinary turned work. Again I sent samples to Mr. Milnes and again he agreed with me that it was the tail roller-bearing, offering to replace it; but, as it would need a special design of reversed cone to fit the housing of the roller-bearing, it would take about three weeks to make. He didn't wish me to be without a lathe all that time, and at the same did not want the machine to turn out imperfect work; if I could suggest a compromise, he would be only too happy to fall in with it. Service and consideration of that sort certainly called for what you might term "reciprocity"; so I suggested that he should supply a temporary bronze bush which I could put in place of the tail roller-bearing, and this would enable me to carry on until the new cone bearing was ready, which I offered to fit myself, to save him further trouble. He thought this a good wheeze, and in 36 hours I had the bush, a lovely bit of turning, exactly fitting the housing and bored a perfect running fit for the tail end of the mandrel which previously ran in the roller-bearing. The bush was installed, and the lathe ran perfectly. I informed Mr. Milnes, and he replied, hoping the bush would last out until he could send along the new bearing, which would be as soon as possible.

The Sequel—23½ Years After!

In the stipulated three weeks the new tail bearing arrived; a cone and socket, hardened and ground, complete with lock-nuts and thrust washer. The socket was arranged to take the place of the outer race of the roller-bearing, and was attached by a flange secured by three screws, similar to the retaining flange of the roller-bearing; the fit of the cone was absolute precision, and would have delighted the heart of Inspector Meticulous. I thanked Mr. Milnes, and told him that I would not fit it right away, because the bronze bush was still "doing its stuff," and time being precious I might as well leave the replacement until the bush began to show signs of wear. The new bearing was carefully stored until required for use.

A year passed away; the lathe still ran perfectly. Another, and another, and no signs of the bush wearing. Eventually, I left Norbury, spent some time in U.S.A., came back, and settled at my present hacienda, this time using a ground-floor room for a workshop, and installing power drive. Still the bronze bush remained in the tail bearing, and the lathe did the job, although driven

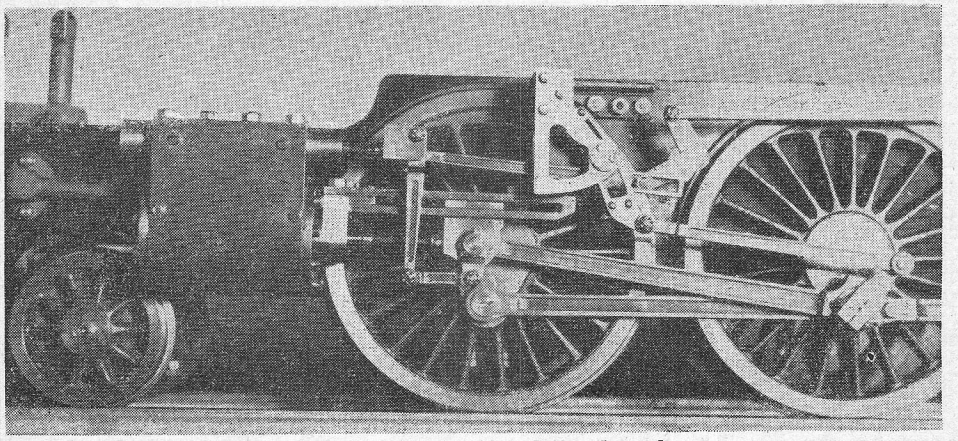


Mr. A. C. Sprong's "City Lassie"—the "works"

by a ½-h.p. motor instead of a foot pedal. I "gave the machine socks," in a manner of speaking, turning 3½-in. gauge driving wheels in two cuts per tread, and taking a cut ⅛ in. deep out of the core-hole of a cylinder. At long last, when turning up the 5¼-in. driving wheels for "Jeanie Deans," signs of chattering appeared on the wheel treads close to the flange. I thought, maybe, the front cone could do with a spot of adjustment, and as it had not been touched since I adjusted it after fitting the bush in 1923, found it capable of being adjusted a little. I finished "Jeanie Deans" and started on two more 3½-in. gaugers, a "Bantam Cock" 2-6-2 and a L.B. & S.C.R. "Grosvenor," my favourite among the single-wheelers, because she had the biggest wheels of the lot, viz. 6 ft. 9 in. When turning the coupled wheels for "Bantam Cock," the chattermarks reappeared; so, thought I, after 23½ years, the old bush is giving up the ghost!

A Perfect Fit

By removing the pinion on the projecting tail of the mandrel and taking out three screws holding the flange over the erstwhile bearing housing, the mandrel can be slid right out through the front bearing; and, as it was only a matter of a couple of minutes' work, out it came. I pushed out the bush, thrust race and distance-washer with my fingers, and examined the bush. It had worn slightly oval; there was an almost imperceptible shake when placed on the tail of the mandrel at the bearing point. I said to it, "Well done, good and faithful servant, you have earned honourable retirement"; went and fetched out the replacement bearing sent me 23½ years previously, and proceeded to fit it. Whilst doing so, I ruminated on the skill and craftsmanship of Mr. Milnes and his workmen. The socket fitted the housing perfectly, just a tight push-fit without a vestige of shake, and the three screwholes came exactly right. The cone bearing is over twice the length of the roller-bearing or the bush, and the ball-thrust race naturally comes in a different place; but the distance-washer—hardened and ground—located it exactly. I could not push the cone on to the mandrel tail with my fingers, but as there were a couple of threads projecting when the cone was in "starting position," I put a lock-nut on, and turned it with a C-spanner, very little pressure being needed to slide the cone along the mandrel into place. The two lock-nuts adjust the cone bearing and the thrust bearing at one fell swoop, the cone being tightened up until the two



Note castle-nuts and fluted rods in the valve-gear

races just hold the ball cage, the lock-nuts being tightened to hold it thus. The big front cone was then adjusted until the mandrel could just be turned easily with my fingers; new trimmings were put in the oil cups (it wouldn't be Curly if he didn't have *some* locomotive gadget or other on his bits of machinery!) and we were all set.

A New Lease of Life

The first job I did on the lathe after fitting the new bearing was to turn up the pump and lubricator eccentrics for "Bantam Cock," which the machine performed with ease, the eccentrics being parted off 1¼-in. mild steel bar held in the chuck, without any chatter whatever. The wheels for the Brighton engine followed, and were turned out perfectly. Since then, the machine has been in its usual regular service, the new bearing giving every satisfaction. As both front and rear cones are adjustable, and hardened and ground at that, I don't anticipate ever having to take the mandrel out again, unless the thrust bearing should ever require renewal—a remote contingency. I don't know whether Mr. Milnes is still alive, as it is many years now since I last heard from him; but, if he is, and anybody calls his attention to the above, I would like him to know that the bush which he sent me as a temporary tide-over for a few weeks at the outside lasted 23½ years, and the new bearing, designed and made at the Bradford works whilst I was using the lathe at Norbury, was a perfect fit and satisfactory in every way. Mr. Milnes visited me twice at Norbury, and I also met him twice subsequently, at machine-tool exhibitions; one had only to speak to him to realise that they were talking to one of the real old school of craftsmen who knew what they talked about. Our worthy "super," Mr. Marshall, will confirm that! As to his lathes, they were among the finest ever produced; I also have one of his old-fashioned machines, as old as myself, with a hardened point tail bearing to the mandrel, old-time slide-rest with inverted vees and horn handles, faceplate-type four-jaw chuck, bell and prong chucks, and other ancient blobs and gadgets. This lathe is infinitely preferable and more suited to the job of turning up locomotive components than any of the smaller and flimsier present-day machines, although the latter have screw-cutting gear and accessories galore. It is a thousand pities that the firm of Henry Milnes, of Bradford, faded out of the picture; Mr. Milnes's son did not carry on when his father retired. The business was sold to a third party, who in turn disposed of all the patterns and stock. All I know is that, if the Milnes type "R" ever appeared on the market again, with the Milnes workmanship, guarantee of accuracy, and at a reasonable price, it would "sweep the board." I wouldn't sell mine at *any* price, unless it was the last thing I possessed, and I had not the wherewithal to buy a meal. Experience still teaches!

An Experimental Profile Grinder

(*Continued from page* 603)

grindstone gave the required backing off to the cutting edges. As the cutting edges were equally spaced round the wheel, they were used in conjunction with a pin gauge to set the height of the cutting faces at the same distance above the centre line of the grindstone.

The feed of the cutter towards the grindstone was obtained by moving the template towards the grinding wheel with the screw feed of the top slide on which the template was mounted. When the wheel was dressed, it was always reduced in diameter only, and not in width, to avoid alterations to the template. The radial distance from the cutting edge to the centre of the cutter was kept approximately the same by grinding each tooth top down until the circular portion on the rim just disappeared. The system is, of course, not free from errors, there is 0.002 in. lost motion in the pantograph and slide and link mechanism. This error could be eliminated by always moving the follower around the template in the same direction when cutting, but it was found to be easier to obviate the error by measuring the tip of the cutter and adjusting the space between the rectangular sides of the template to suit, as this adjustment need only be made once. The diameter of the teeth of the cutter varied slightly, so that only two or three teeth cut when in use, but this does not matter very much, and happens very frequently in far better equipped workshops than the writer's. One further disadvantage is that the major cutting operations are carried out with the corner of the emery wheel so that the wear on the stone has to be watched carefully. This can be checked by measuring the width of the cutter at the tip after each cutting edge is ground.

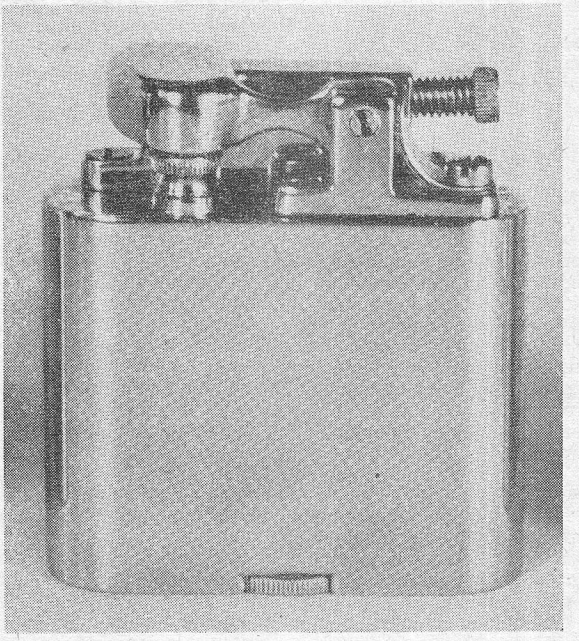
Against the above disadvantages it may be mentioned that it is necessary to be 0.0235 in. out of truth on the template before a 0.001-in. error appears on the gear-tooth profile, so that a reasonably sharp pencil and careful draughtsmanship when drawing out the involute curves for the teeth, will give good results on the cutter.

The gear wheels I have made with these cutters are very smooth running and can be mated up with negligible backlash without running-in with grinding paste. The time and trouble required to construct the apparatus have been well worth while, as it is now only necessary to draw out a template, rough out a cutter blank, and one can produce a cutter for any desired tooth form one may require in about four hours. Incidentally, the device can be applied to the profile grinding of almost any small milling cutter, for fly cutters and for lathe tools which require to be accurately formed, for example, thread cutting tools. Chasers could also be made in the same way, but would require specially formed grinding wheels. The wheels could be formed on the device by using a diamond dresser mounted in the place of the milling cutter blank and formed in conjunction with a suitable template.

As will be seen from the photograph, the contraption is very poorly finished, but it was made as an experiment involving a minimum of labour and has only one claim in its favour—it works. I hope that some other readers who have been faced with similar problems may find the device of interest. The photographs were taken by A. Hann.

*The "M.E." Petrol Lighter

By Niall MacNeill



THE raw material is 9/32-in. silver steel and if the chuck runs reasonably true there is no need to turn down larger stuff to this diameter. The blank should project from the chuck only as far as will allow of parting off the finished wheel, and all bearings and slides should be adjusted fairly tight. The blank is faced and drilled to a depth of $\frac{1}{8}$ in. full (using No. 43 drill, or 42 if the axle pin is to be made from a dental burr). It will facilitate toothing if the parting off is initiated first by feeding in the parting tool to a depth slightly greater than the tooth gullets. Accurate sizing for width can be quickly secured if the top slide feed screw is fitted with a micrometer collar. "Mike" the width across the cutting edge of the tool and add 0.125 in. to this measurement. Perform or finish the facing operation with the parting tool and then feed towards the chuck by the amount found from the calculation just described.

Cutting Teeth

Set the dividing appliance to give 44 or 45 divisions. For toothing, a knife tool, having its point ground to 45° and with *nil* or even slightly negative top rake (using the term in its ordinary sense), is set on its side in the toolpost, knife edge uppermost and at centre height—point, of course, facing towards chuck. Clamp tightly. The teeth are cut by traversing the tool across the periphery of the blank. Do not attempt to cut the teeth to full depth at one round. Use a magnifier to inspect the progress of the work and continue until no lands remain or they are barely discernible. Minor irregularities shown up by the magnifier are of no consequence. Slightly bevel the inner flanks of the teeth with a fine file; reason—this is the only part of the wheel that can hurt even a tender-skinned thumb by its sharpness. Complete the parting off. Remove any burring from the rims of the drilled hole; hand application of a "square centre", being a satisfactory method. Harden in the usual manner, but do not draw the temper. The wheels give long and satisfactory service in dead hard condition. It is thought that case-hardened mild steel would give equally good results, but since wheels can be simply and satisfactorily made as above the writer has not tried this method.

When the wheel is inserted in its slot the teeth should actually touch the lips of the flint "tube" and it is no fault whatever, but rather the contrary, if it is necessary to force the wheel round a few turns on its axle in order, so to speak, to "mill" a free seat for itself at the tube-head. "E.H.E.," writing in THE MODEL ENGINEER of February 4th, 1943, has already pointed out that this setting of the flint-wheel, "with 'its nose to the grindstone'," is the correct one. The wheel may even refuse to accept the axle-pin initially; if so, "mill" it in, using a taper point, such as the head of dental burr, as temporary axle.

Flint-wheel Axle and Cap-hinge Pins

The flint-wheel axle-pin ($\frac{1}{4}$ in. long) and capping-hinge pin ($\frac{3}{16}$ in. long) are headless 8-B.A. "bolts" screwed in both cases for a shade over $\frac{1}{16}$ in. of their lengths. They may be made of steel wire or rodding turned down to the correct diameter (0.087 in.), but—as has already been suggested—old dental burrs make admirable blanks for the purpose. These are 0.092 in. in diameter, hence the previous suggestion of using No. 42 instead of No. 43 as clearing drill. They are made of very good quality (high speed) steel, but the shank ends are soft enough to be screw-cut without difficulty yet extremely resistant to wear. They have the pronounced advantage in the present capacity that the screwdriver kerf (which should be made with a very fine slitting saw or worn midget hacksaw blade) will stand up to its work without suffering deformity. The possibility that the screw will become rusted in—a pronounced one if the job is to be sent to be chromium plated—need not therefore cause any alarm. A mild-steel pin, in the same circumstances, may be found quite impossible to

*Continued from page 578, "M.E.," December 12, 1946.

extricate, and the kerf, after a few attempts to use it, be completely destroyed. Almost any dentist will be found only too ready to give away his worn burrs (one of which, incidentally, could be ground and fitted with a handle, to serve as a natty little screwdriver for use with these and other midget screws).

Flint-spring Adjusting Screw

This is made from $\frac{3}{16}$-in. round brass to the shape and dimensions shown by Fig. 16a.

Flint-spring

The material in this case is a short length of 28-s.w.g. springy steel wire as provided by a single strand from an old Bowden cable. Avoid, however, rusty stuff or the finer (30-s.w.g.) wire used in some of the lighter Bowden controls. It is simply wound by hand, using the bench vice to secure one end of the work, on a mandrel consisting of 16-s.w.g. steel wire (birdcage wire). Wind tightly, then ease to and fro (lengthwise) on the mandrel until the coils are "air-spaced" about 1/32 in. No heat treatment is necessary. For each spring, a length containing not more than about 12 coils is cut off. This will become compressed in use to about $\frac{3}{8}$ in. The end coils are very slightly bent inwards.

Spring-head Pellet

This refinement should on no account be omitted. It can be made from any small scrap of brass or with the utmost simplicity from 12-s.w.g. brass wire, to the dimensions shown in Fig. 16c. The "necking" or undercutting, both of this and of the spigot on the screw, can conveniently be done by the same means as was suggested in dealing with the chimney. These necks provide for assembling screw, spring and pellet together as a unit, with manifest convenience on occasions of flint renewal.

Capping Unit

This item is perhaps the trickiest job of the lot, but with the exercise of a little care and ingenuity the difficulties will disappear. As a factory job, the *ovoid* cup or cowl would probably be made as a pressing. In the home workshop the unit should be made as an assembly of four parts, all joined by silver-soldering and given an externally polished and graceful appearance only after correct fitting by careful mounting in position. Reliance should not be placed on soft-soldering for joining the components of this unit, since the probability is that the joints would soon disintegrate from fatigue, due to the repeated impacts and leverage to which they are subjected in the use of the lighter. For the same reason, none of the parts of the unit should be made of stuff thinner than 20 s.w.g.

(*a*) *Chimney Cap.* This is made from $\frac{1}{4}$-in. round brass to dimensions shown by Fig. 17. The height is given as $\frac{1}{4}$ in. approximately, because the exact height should be found by applying this part (unfinished as to length) to the lighter having first mounted the ignition-head and chimney thereon, and should be such that the under-surface of the "roof" of the cowl will just comfortably clear the top surface of the ignition-head, when the 60° tapers of the chimney and cap are properly mated. The diameter 6 mm. was chosen simply to match an available collet, but this dimension should not be widely varied unless the smaller radius of the cowl is altered to suit. The internal tapering can be done with a "square centre" provided care is taken to avoid chattering. Whether to drill through or use a blind hole (as shown by pecked lines in Fig. 17) is a matter of choice and, in fact, this component may be made of tubing if suitably thick-walled stuff of near correct diameter is available.

(*b*) *Rim of Cowl.* This is a strip of sheet brass (20 s.w.g. or thereabouts) bent to the shape shown in elevation and plan by Fig. 18 (i) and (ii), and such that the external dimensions and radii approximately conform to the values given in Fig. 18 (iii). The small slot shown in (i) and in the perspective (iv) should be a tight fit for the shank to provide for secure assembly for silver-soldering, and should be located with reference to the position to be occupied by the chimney-cap as indicated by Fig. 20.

(*c*) *Roof of Cowl.* This item, of sheet brass—20 or 19 s.w.g.—requires initially only rough cutting to shape provided it is amply roomy to receive the rim as shown by Fig. 20. It is also slotted to receive the point of the shank to obviate displacement during silver-soldering.

(*d*) *Shank.* Unless it is intended that the lighter should not be plated, this item should be made entirely of steel, 16 s.w.g. being minimum thickness and 14 s.w.g. maximum, whatever material is used. If made entirely of brass, wear will soon occur at the "heel"—point marked "X" in Fig. 19 (iii). If, therefore, it is desired to use the lighter unplated, a steel tip should be silver-soldered to this component as indicated by the shading at "X."

The dimensions given in Figs. 18, 19 and 20 are intended more as a guide than with the idea that they should be copied with minute accuracy. If the "roof" of the cowl is first fashioned to near its finished dimensions, the other parts can, in fact, be cut and formed to shape and size by eye.

One of the photographs reproduced gives a good impression of the finished condition of the capping unit and the manner of its mounting.

Cap-hinge Spring

For this procure a short length of light clock-work spring, stuff which is about 0.015 in. in thickness and not less than 5/32 in. in width being suitable. These springs can be fashioned from this stuff without heat treatment provided a punch will make a hole about 0.09 in. in diameter is made or procured. The ends should be radiused by grinding. Initial length in more or less flat condition will be about $\frac{5}{8}$ in. It should be set, by judicious use of a round-nosed pliers, to a degree of curvature which will give sufficient pressure on the capping unit to click it sharply shut and hold it firmly in the shut position, yet not be so strong that undue effort is required to un-cap the lighter. It is a very good plan to use a double-leaved spring. However good the material and however

carefully finished, this spring is a vulnerable item and the two-leaved variety has the merit that if one leaf should fracture the other will serve well enough pending a replacement. In this case, of course, the leaves will require less forward set than if a single leaf is used.

It is worth noting, in case spring stuff of the correct width should not be easily available, that this kind of spring (in its tempered condition) can be cut by snips quite easily along, but not across, the grain.

Screws for Assembly

For this purpose, four 8-B.A. brass screws are required, three having countersunk heads and being $\frac{1}{8}$ in. long under heads and one a cheese- or round-head from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. long under head for securing capping hinge spring).

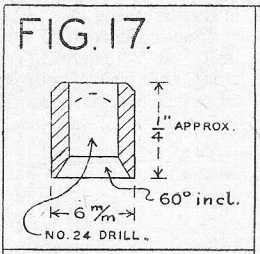
Plating and Finishing Touches

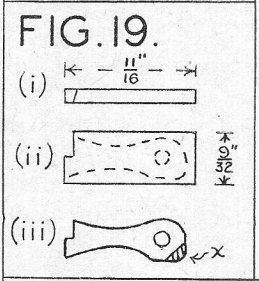
If sending the job out for plating, remove and keep at home the flint-wheel and flint-spring (with its pellet). To prevent unwanted rounding of the edges of the flint-wheel slot in the course of buffing operations by the platers, it is a good plan to fit a dummy wheel consisting of a piece of 7/32-in. round brass drilled to take the axlepin and parted off at $\frac{1}{8}$-in. width.

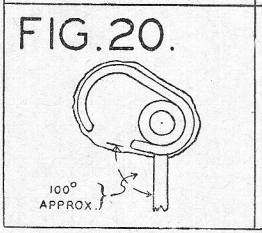
On return from plating, or before final assembly if not being plated, the body of the lighter should be suspended by a wire for a few minutes in a pot of boiling water. This will clear out any occluded residues of flux, plating solutions, swarf or abrasive dust, especially if rinsed and returned four or five times to the boiling water. Dry off in a gentle heat, i.e., heat well below the melting point of the soft-solder.

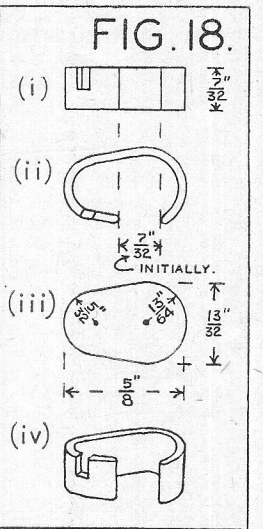
If not to be plated, the job of bringing the various external surfaces to a high polish will devolve upon the maker. Care should be taken that the flat condition of the joint faces of the headplate and "upperworks" are not thereby impaired. The plating firm should be warned to the same effect if the work is sent to them, especially in view of the fact that the component parts should be taken asunder to make a really good job of the plating.

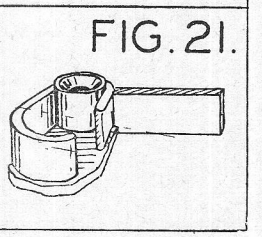
Notwithstanding these precautions and that the joint-faces should be fairly fuel-tight themselves if properly made, it will be well to use some "dope" between them, such as cylinder-head jointing compound, on final assembly.











Wicks

Single strands of asbestos rope lagging make admirable non-smouldering wicks, rarely if ever requiring any adjustment after the first and certainly not replacement unless, after very long service, they become clogged with oily residues left by poor fuel. They have one fault, which is sluggishness of the capillary action, i.e. the fuel flows rather slowly along the wick. This, however, is of no consequence except perhaps to pipe-smokers or to those people who do things without their minds on the job in hand—exemplified in this case by keeping the lighter alight while engaging in long conversation (which isn't good for it, anyhow). And, by the way, if a pipe-smoker should tell you that a pipe cannot be satisfactorily lit with a liquid-fuel lighter, you may retort with an assurance that you are correct and not he, that his opinion is purely the outcome of habit and the knack of using a lighter for the purpose is more easily acquired than is the correct manner of using a match. If he comes back with something about tainting the tobacco, tell him (as is true) that this is either a matter of imagination or of foul fuel. The writer is a pipe-smoker with a not uncritical taste regarding the "flavour."

Filling and Operating

Fill the lighter with clean cotton wool, fully but not to the extent of ramming it. Insert flints in the working and spare positions. Fix cap-screw washer permanently to the under-surface of the screw-head by means of some good adhesive. Fill, but do not overfill, the lighter with good fuel, such as "straight" petrol. If "the words and music" (if I may borrow that expression) have been followed, the job will never let you down so long as flint and fuel last, and a fill will last upwards of a month even in the case of a cigarette chain-smoker. As to pipe-smokers, one cannot be so confident, because so many of them seem to enjoy lighting rather than smoking the pipe and treat the lighting ritual itself as one to be interlarded with gossip.

The photographs were taken by J. P. Cassidy.

*Railway Interlocking Frames

By O. S. NOCK, B.Sc., M.I.Mech.E., M.I.R.S.E.

No. 10—Dutton's Catch-handle locking apparatus

THIS type of locking apparatus was extensively used on the Great Northern Railway. Tappet locking is employed, actuated entirely by the catch handle. The resulting motion of the locking is the same, in effect, as with the Saxby "rocker and grid" frame, in that half the drive motion results from the lifting of the lever catch handle, and the remainder of the motion is produced when the lever stroke is completed and the lever catch drops into the notch on the quadrant. The Dutton frame is, however, distinctly original in appearance both above and below the cabin floor. Fig. 1 shows a cross-section; in this it will be seen that the quadrant rises towards the signalman. This would at first suggest a most awkward "pull," but owing to the position of the lever fulcrum the motion of the lever handle is more or less normal. Before leaving the handle and turning our attention to the locking mechanism the parallel lever handle should be noted, and also the unusual form of catch handle; the latter, instead of being flat on the side next to the lever and rounded at the back, is of circular cross-section and ¾ in. diameter. In the normal position the lever is vertical, as in the McKenzie and Holland types of locking apparatus.

Below the floor the lever is L-shaped. This design is adopted so as to provide a fulcrum for the multiplying lever "A" of the drive from the catch handle to the locking tappets. The motion of the various members of the link mechanism at different points is shown in Fig. 2. When the lever catch is lifted a downward motion of 2 in. is imparted to the link "B"; the roller at the lower end moves along the curved slot in the lever cap and the tappet is moved 1 in. During the stroke of the lever, from normal to reverse, the pin joint "C" moves radially around the lever fulcrum, but during this action the movement of the link "D" is very small, only ⅛ in. in the upward direction. At the conclusion of the stroke, when the catch is allowed to fall into the notch, the pin joint with its roller, "C," moves back along the curved slot in the lever cap. Owing, however, to the new position of the lever cap this movement imparts a further downward movement of 1 in. to the locking tappet, making a total stroke of 1⅛ in. Some mechanical details of the mechanism shown in Fig. 2 are given in Fig. 3. The link "A" actually consists of two separate straps, 1½ in. × ⅜ in.; these are connected to the catch rod by the knuckle joint shown in Fig. 3a. The link "B" is a forging (shown in Fig. 3b), with a forked lower end, where it fits over the lever cap, and an eye at the upper

(*Cont. on page* 617)

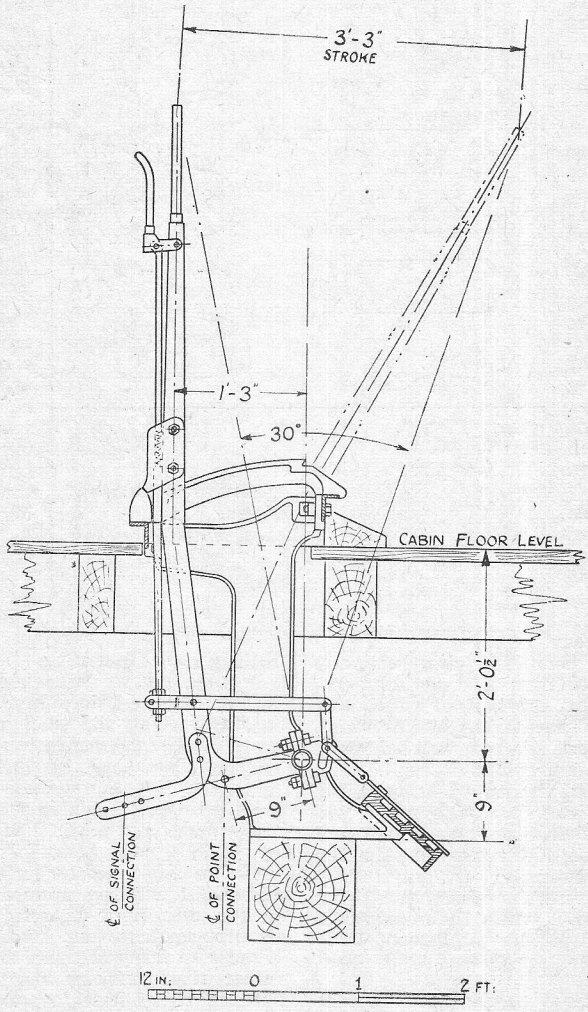
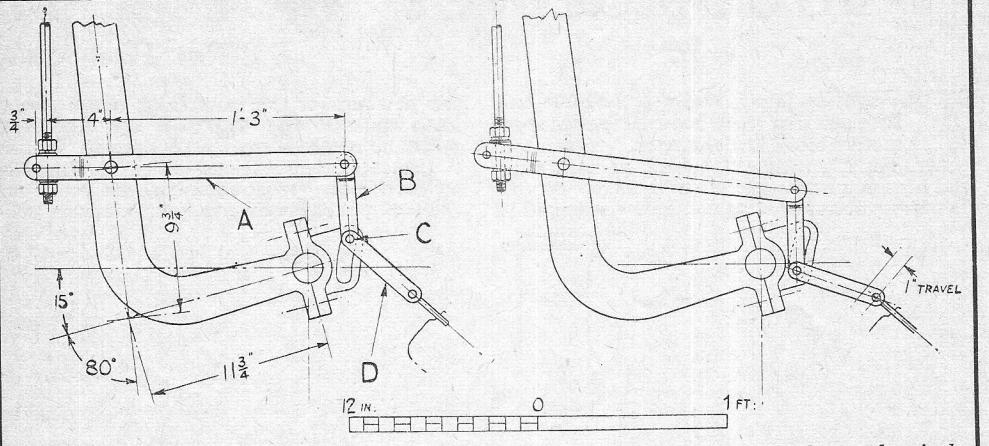


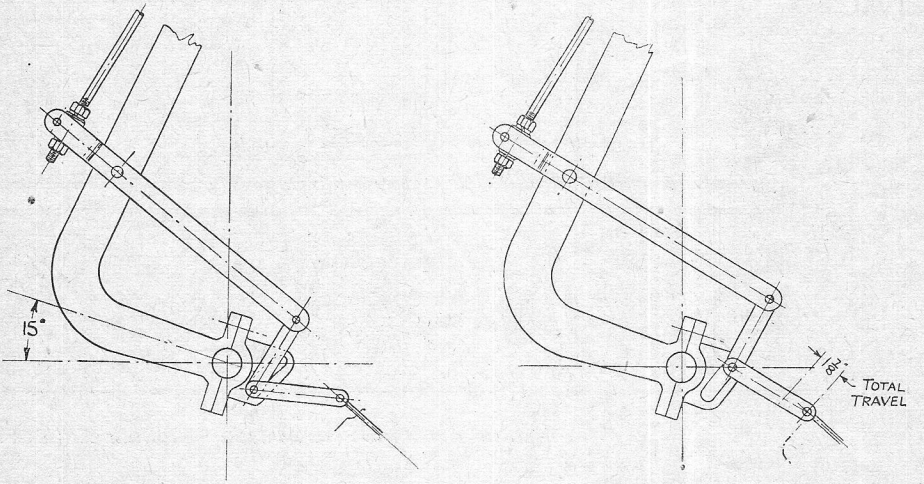
Fig. 1. General arrangement

*Continued from page 294, "M.E.," September 19, 1946.



(1) *Lever normal : catch down*

(2) *Lever normal : catch raised*



(3) *Lever reversed : catch still raised*

(4) *Lever reversed : catch down*

Fig. 2

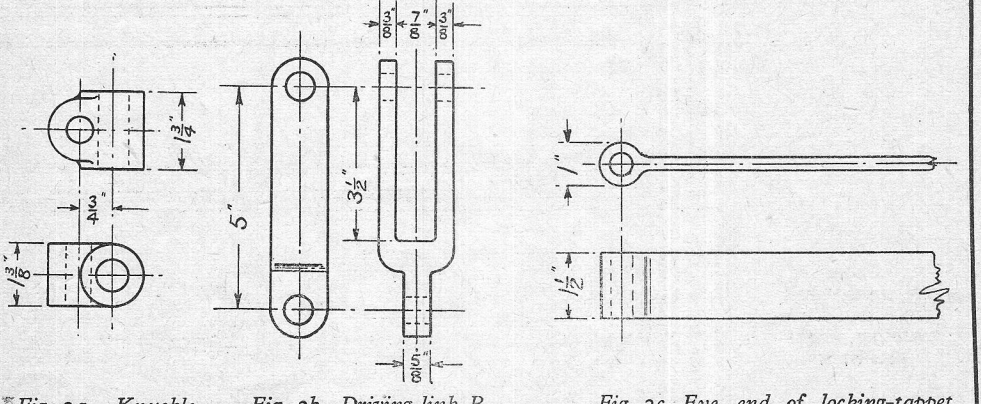


Fig. 3a. Knuckle

Fig. 3b. Driving-link B

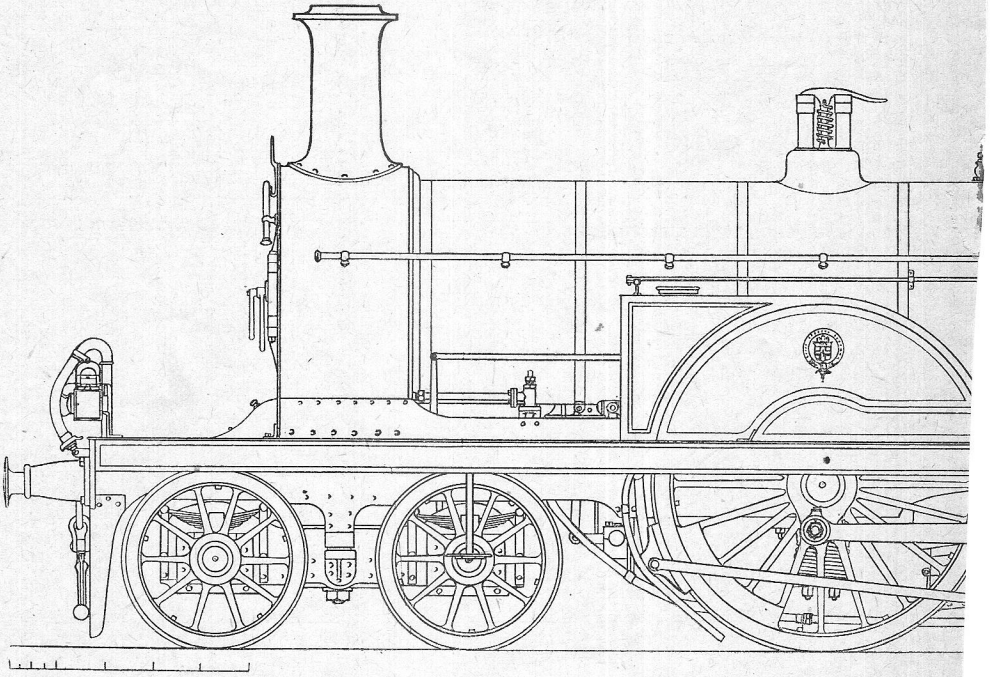
Fig. 3c. Eye end of locking-tappet

LOCOMOTIVES WORTH MOD

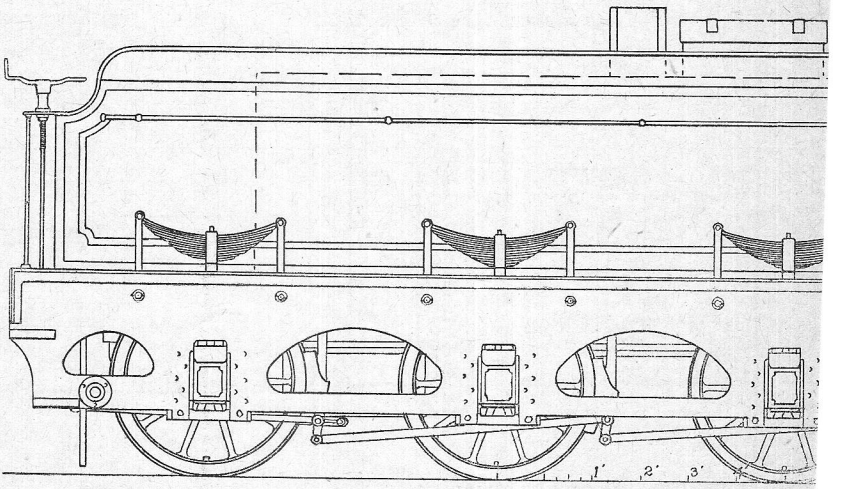
No. 19.—South Easte

THE Stirling family was a remarkable one. It seems that there must have been locomotive blood in their veins.

Mr. Patrick ruled, of course, at Doncaster, and his son was also in the works there. Brother James was in command at Ashford, wisely guiding the destinies of the interesting South Eastern line, whilst Brother Matthew was likewise in power up north on the Hull & Barnsley Railway. A glance at their various designs prompts one to feel that they must often have gathered round the family table, and agreed on a common policy



No. 240 was a noble representative of English design at the Paris E



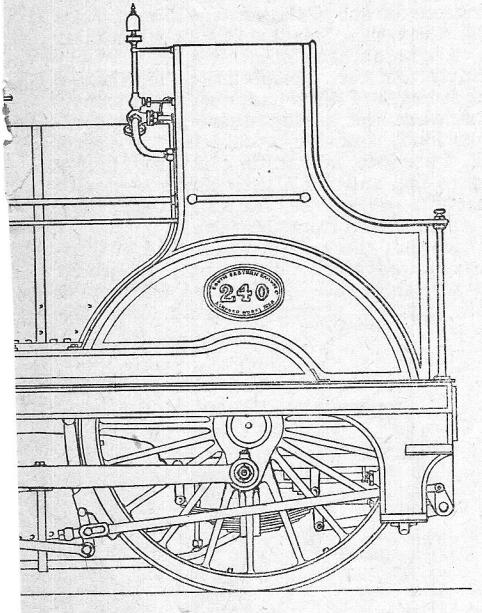
The tender of 240 had deep frames and compensating brake pull-rods

ELLING by F. C. Hambleton

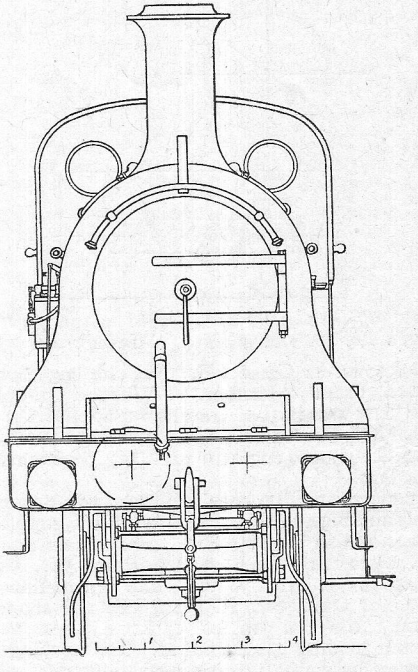
rn Railway No. 240

as regards matters of mechanical detail. The resemblance between their engines was most striking. However, one point of real divergence appeared. Whereas Mr. Patrick would have none of the bogie—except when compelled to, as in the case of his "eight-footers," Brother James was very keen on its employment, sealing his approval by planning his own excellent version of this useful invention of William Adams.

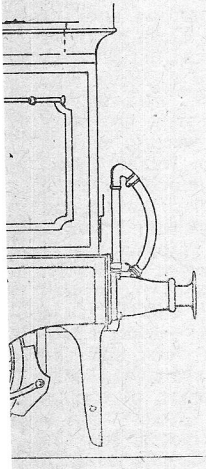
It was hardly surprising, then, that when the S.E.R. required new and more powerful express

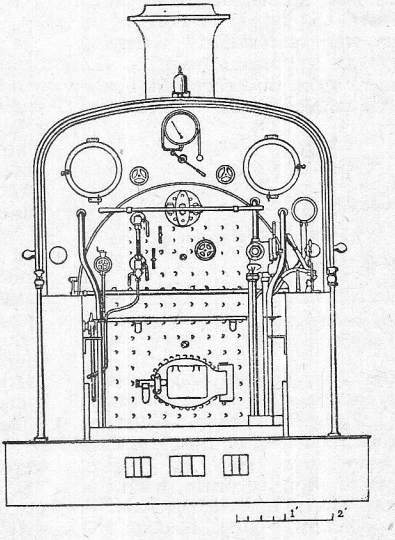


bition of 1889



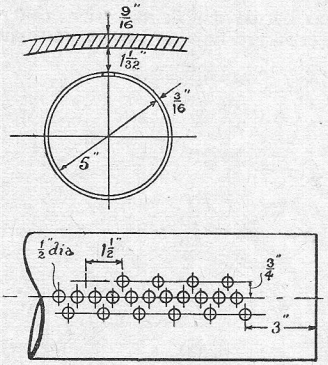
A finely-designed wingplate was a feature of No. 240





Compare this layout with that of G.N.R. No. 1!

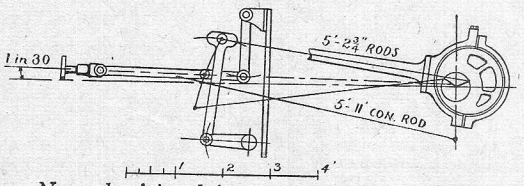
engines, James Stirling introduced his 4-4-0 type, which had proved previously so successful on the Glasgow & South Western Railway, in Scotland. The first of these new engines was constructed at Ashford in 1883. She was No. 205, and the whole 88 engines comprising the class were built at the company's works, the last one, No. 233, in 1898. Officially they



260 half-inch holes were drilled on the upper surface of the steam pipe of Stirling's engines

were known as Class "F," but the enginemen dubbed them "Jumbos." What a popular name that was! (One recalls its application to the L.N.W. Precedents, and to the big Stroudley L.B.S.C. goods engines 421-432, to mention but a few.)

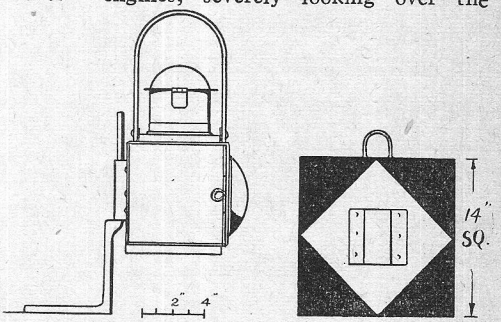
Characteristically, they had large 7-ft. driving-wheels and big 19-in. by 26-in. cylinders, supplied by a smallish boiler, 4 ft. 4 in. diameter by 10 ft. 4½ in. in length, and a short 5 ft. 9 in. firebox, pressed to 150 lbs. The centre-line of the boiler stood at 7 ft. 5 in., and the shapely chimney towered up to 13 ft. 4 in.—a very generous loading gauge indeed. The spacing of the wheelbase was interesting; only 5 ft. 4 in. between the large 3 ft. 9 in. bogie wheels, but the driving wheels were spread out to as much as 8 ft. 6 in., the total totting up to 21 ft. 0¾ in. These proportions were particularly satisfying to the eye, always an important point to the loco-modeller, and resulted in a taut and handsome balance to the whole engine. The thirty-



Note the jointed intermediate valve spindle of the link motion

fourth engine of the class, No. 240, was destined to become famous, for she was sent, when brand new, to the Paris Exhibition of 1889. Here she was awarded a gold medal, and after running some exciting competitive trials in France, returned to her native shore to share, with her sisters, incessant railway toil. Like the L.N.W. Jumbos, the S.E. Railway engines bearing the same nickname, formed the backbone of the express service. Such celebrated trains as the "Granville" to Margate, and the Folkestone "Tidal" fell to their lot, whilst their work with the Continentals gained them yet a third soubriquet, that of the "Mails." I shall not readily forget my first impressions of No. 240, standing magnificently upright in the little old Ramsgate Town station. Here, in that quaint S.E.R. terminus, the platforms were distinctly low, and the fine Stirling engine towered above its very youthful admirer. The most exciting thing about our encounter was the fact that the celebrated engine began to sing to me! Sing to me? Yes, indeed, for one of the accomplishments of a Stirling safety-valve was that of gently humming a nice clear note when commencing the blowing-off antics. As the pressure rose, so likewise did the strength of the sound, until there came a moment when the hissing steam grew uncomfortably loud, and the vocal effort suddenly ceased. I was sorry at that, for I liked my engines to sing to me, and felt a little anxious—not to say nervous—when the fearsome column of white steam roared from the valve.

Ramsgate, in those days, was a land of locomotives painted black. Down at the harbour station were those nice old Kirtley "Chatham & Dover" engines, severely looking over the



"Right-away" for Folkestone! Headboard and lamp displayed on this route

turntable wall at the winkle-barrows and the wind-jammers, whilst up at the Town terminus stood S.E.R. No. 240, also decked out in black relieved by three red lines and a yellow one. These were arranged on this wise: first came an outer fine red line, inside this were the other two red lines, forming, as it were, a narrow panel in which was placed the yellow stripe. Viewed from the front, the eye moved from the red buffer-beam (edged with black border and fine inner white line) up to the handsome "wing" front plate of the smokebox. This was a very elegant affair and set off the engine admirably. Dean, Drummond and Mackintosh favoured this adornment, it may be recalled, and I always felt that the G.W.R. "Barnums"—those handsome 2-4-0s—the L.S.W. 708 class, and the "Dunalastairs" owed much of their good looks to this particular feature. Domes, of course, were always objects of great interest, but a "straight-back" also had its charms, and the placing of my tenor singer (*alias* safety-valve), with its black-painted cover—it was many

years before this feature was polished up in garish fashion—made an interesting "top-side" to the engine.

The long cylindrical chimney was a novelty, for not many parallel-sided funnels could be seen, but it was what the modern schoolboy would term a "smasher" A strong family resemblance to the G.N.R. pattern could be felt, and somehow it looked "just right" on every type of engine. In particular it suited the old Cudworth engines, converting the excellent but slender-looking locomotives into sturdy fellows. And it suited 240 to perfection. The little 12-in. windows in the lovely round-topped cab were most attractive, not to mention the whistle perched up aloft, and the fascinating rake, at all sorts of funny angles, of the brake pull-rods. The tender was grand, with its "above footplate" springs and deep framing, and, indeed, one fell in love with the whole engine the instant one clapped eyes on her. (There I go again—all my engines are swans!)

What a wonderful headboard was placed at the top of the smokebox when running express trains! A great square thing it was, with black corners. To keep it company, two red-painted head-lamps were slipped on to the buffer lamp-irons. They were nice big comfy-looking objects with the unusual feature of a hinged wire handle. They were kept high about the footplate by a little bend in the lamp-iron—a very sound design, and simplicity itself.

The one big detail of the motion was the employment of the very old-fashioned jointed intermediate valve spindles, slung at the outer ends from vertical swing links, a feature these engines carry to this day. I wonder how you like the cab arrangements? It was a nice looking scheme, with, of course, the family flavour, and popular with the men. Personally, I cannot recall ever seeing a model of 240, which is strange, because apart from good looks, she had a kind of bounding-along appearance! when running—most attractive.

The Southern Railway has always regarded these engines highly, for they have been kept well up to date, and had to work hard for a living. But you can't see their good looks nowadays. No, one would have to shunt back to the 1890's to do that. It would be fun, wouldn't it?

Useful Dimensions

Bufferbeam to centre of bogie pin	5 ft. 2 in.
Bogie pin to driving axle	10 ft. 0¼ in.
Rear overhang of frame	4 ft. 4 in.
Footplate above rails	4 ft. 4 in.
Centres of buffers apart	5 ft. 8 in.
Centres of buffers above rail	3 ft. 5 in.
Diameter of smokebox	2 ft. 7 in.
Length of chimney	3 ft. 4⅜ in.
Diameter inside chimney	1 ft. 4 in.
Diameter of boiler lagging	4 ft. 6 in.
Diameter of safety-valves	2½ in.
Length of connecting-rods	5 ft. 11 in.
Length of eccentric-rods	5 ft. 2¾ in.
Ports, 1½ and 3½ in. by 16 in.	
Travel of valve	4 5/16 in.
Lead of valve	5/16 in.
Lap of valve	1 in.
Height of cab	7 ft. 0 in.
Width of side sheet	2 ft. 11 in.
Throw of coupling-rods	1 ft. 0 in.
Width over cab	6 ft. 0 in.
Width over footplate	7 ft. 7 in.
Width between 1-in. frames	4 ft. 1 in.
Centres of cylinders	2 ft. 4½ in.
Inclination of cylinders	1 in 30
Tender wheelbase	12 ft. 0 in.
Tender wheels diameter	4 ft. 0 in.
Width over tender tank	5 ft. 8 in.
Between ⅞-in. frames	6 ft. 7¼ in.
Leading overhang	4 ft. 2½ in.
Trailing overhang	3 ft. 10 in.

RAILWAY INTERLOCKING FRAMES

(*Continued from page* 612)

end to go between the two straps forming link "A." The joint at C has a ⅝-in. diameter pin and carries a roller 1-in. diameter working in the curved slot in the lever cap. Lastly, there is link "D," again consisting of two straps, 1 in. × 5/16 in. in section, and fitting over the jawed end of link "B" at one extremity and over the locking tappet at the other. The tappet is shown in Fig. 3c, and has a forged eye on the upper, or driving end.

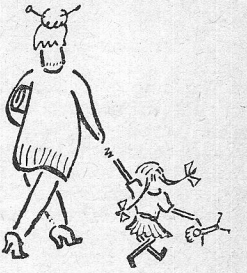
The frame itself is built up in the usual way, on two 3 in. × 2 in. × ⅜ in. angles running longitudinally throughout, the angles themselves being supported on a series of standards. In the front, at floor level, there is a footboard for the man. The spring catch box on the lever is of a similar type to that used on the McKenzie and Holland "cam and rocker" frame described in the June 20th and 27th, 1946, issues of THE MODEL ENGINEER, though provided with a stop to limit the backward stroke of the lever.

The reader will probably have remarked by this time in the series upon the surprising differences in lever stroke and general proportions above the floor. The Dutton frame has an average length of stroke, 3 ft. 3 in., comparing with the 2 ft. 6 in. of the Stevens and the 4 ft. 0 in. of the Saxby "Rocker and grid." The angle of movement of the lever in the Dutton apparatus is 30 degrees. A long stroke gives an easier pull for the signalmen, which is particularly valuable when operating crossovers and distant signals located a long way from the signal box. There is also considerable variation in the pitch of levers. In earlier frames the levers were spaced 5 or 5½ in. apart, whereas later designs, prepared with a view to reducing the size of the cabins, have used a 4-in. pitch. The Dutton frame uses a 4-in. pitch of levers. The main shaft on which the levers pivot is 2 in. diameter, and this is turned down to 1⅞ in. for the width of the lever bearing. This provides a longitudinal register for the levers, as in the McKenzie and Holland cam and rocker type of frame.

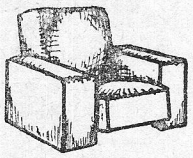
(*To be continued*)

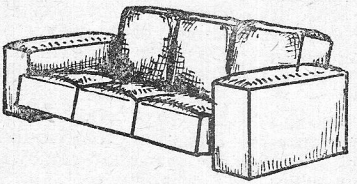
"1121" says—

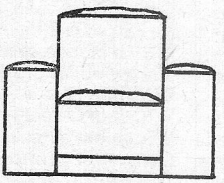
"Don't Forget the Girls"

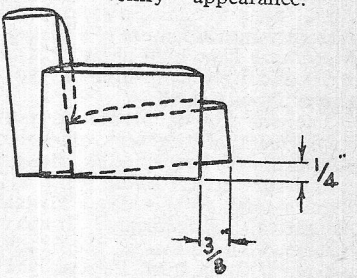


THE little toys which form the subject of these sketches cannot, perhaps, be classified as strictly "model engineering," but nevertheless they are just the kind of thing which the "model engineer" may be called upon to produce at this time of the year. From personal experience the writer can assure anyone with a small daughter, niece, sister or anything like that, that these little chairs are "just the job," and will go down very well indeed. They have the virtue of being very quick to produce, and yet looking most luxurious when finished. They are made from matchboxes, covered with rexine, American cloth, or any other odds and ends which may be available, and it is hoped that the sketches are sufficiently clear to render any further description unnecessary. The padding on seat, back and arms is cotton-wool stuffed in before folding over the last edge and glueing down. If it is proposed to make any quantity, it is recommended that tin or cardboard templates be cut for the different pieces of material, and if there is a shortage of matchboxes, blocks of ¾ in. by 1½ in. wood can be cut, 2¼ in. long, instead. Don't forget the slope of the seat and back, as this is what gives the "comfy" appearance.

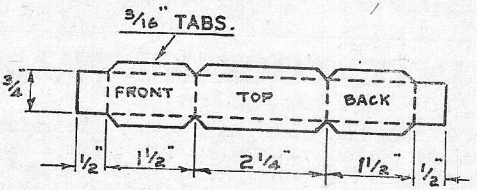




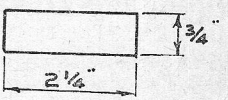


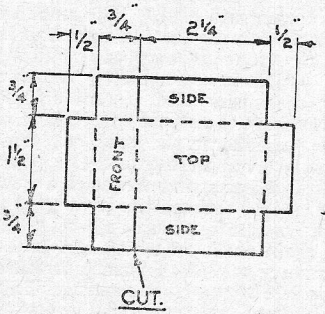


ARM WRAPPER. 2 OFF.

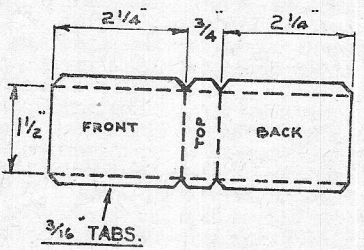


BACK PANEL. 2 OFF.

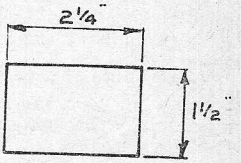




SEAT. 1 OFF.



BACK WRAPPER. 1 OFF.

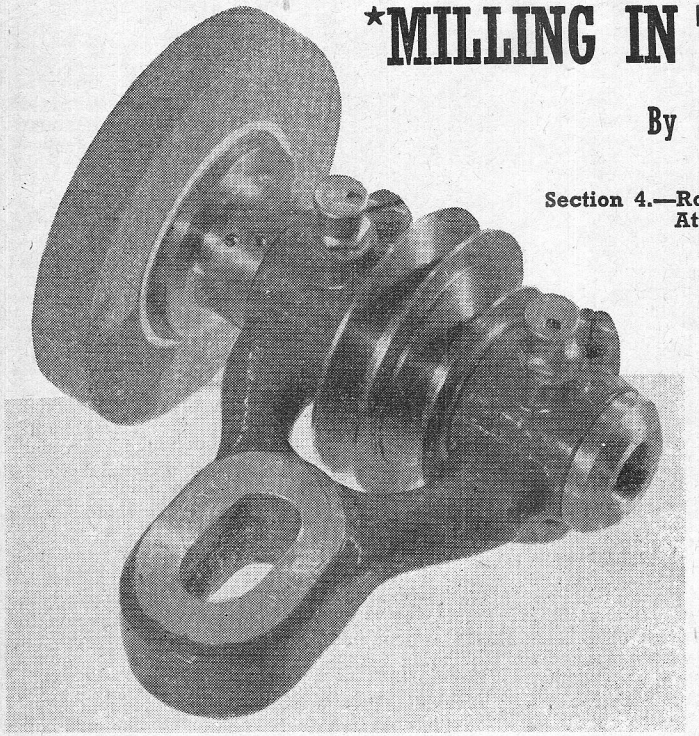


ARM PANEL. 4 OFF.

*MILLING IN THE LATHE

By "NED"

Section 4.—Rotary Spindle Milling Attachments



The Potts grinding spindle

A general review of the principles, appliances and methods employed for adapting the lathe for various types of milling operations

MENTION has already been made of the many types of rotary spindle appliances which are, or have been, provided as special equipment for various makes of lathes. Generally speaking, these differ only in detail from the types of attachments which have been described here, and call for no special comment. The accessories for well-known types of horological or instrument lathes nearly always include milling spindles of some kind or other, and among manufacturers of lathes known to model engineers, Drummond, Milnes, and Britannia formerly listed special attachments of this type.

Grinding Spindles

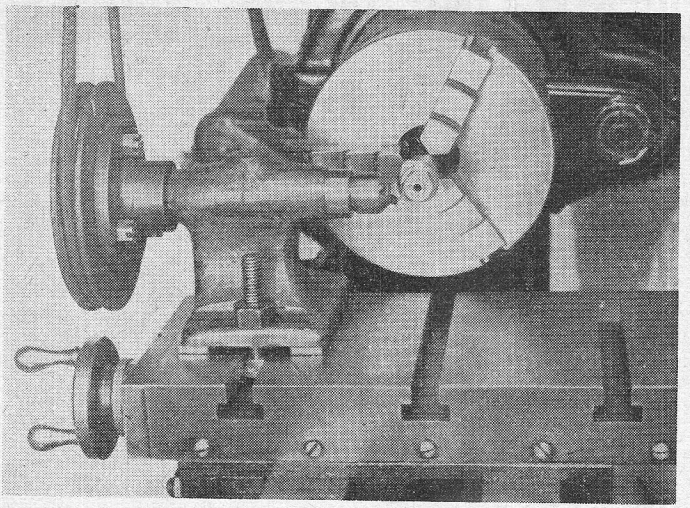
Strictly speaking, these do not come within the scope of the present treatise, but as they have much in common with milling and drilling spindles, a passing mention of them may be justified. Some forms of milling spindles can be, and have been, used to carry internal or external grinding wheels, but generally, it may be said that the special quirements of regrinding spindles, namely, light and easy-running bearings, with provision for running at very high speed, are not well catered for in the form of appliance best suited for milling purposes. The speed required for really efficient grinding with small diameter wheels may be of the order of 20,000 r.p.m., or even higher, which is not easily attained with the usual means available for driving these spindles, and there are many other special problems in the application of grinding processes to ordinary lathe work.

Mr. G. P. Potts manufactures a special grinding spindle for use in the lathe, having provision for carrying a wheel for external grinding at one end, and a socket, tapered for No. 1 Morse or "A" size collets at the other, to take an extension spindle for internal grinding wheels. As seen in the illustration, the frame is adapted to clamp on the top slide of the lathe by the usual single tool-post stud, and split bronze bearings are fitted, with adequate lubricators. This spindle runs very sweetly at high r.p.m., and is well balanced, so that no perceptible vibration can be detected

Cam Generating with the Milling Spindle

An interestig application of a simple milling appliance for producing cam profiles of high precision was described some years ago in THE MODEL ENGINEER, by Mr. D. H. Chaddock. The milling spindle in this case was made, or at least adapted, specially for the purpose, using a small headstock made from a lathe tailstock casting to house the spindle bearing at exactly the same height as the lathe centres, when mounted on the cross slide. Any of the milling spindles described above, however, could be used, if mounted horizontally. The spindle nose was arranged to carry a single fly-cutter at an angle of 45 degrees, as in the example illustrated in Fig. 7 (page 107, August 1st issue), and functioned as a small face mill, operating on the cam blank held in the lathe chuck. To produce the correct cam profile, a combination of indexing movement of the lathe spindle, and cross move-

*Continued from page 564, "M.E.," December 5, 1946.



Arrangement of cutter spindle for generating cam profiles, as used by Mr. D. H. Chaddock

ment of the slide, was employed, the exact lift of the cam at every angular position of rotation being previously worked out. In the event of the cross slide not being fitted with a graduated index, or the precision of the latter being dubious, a dial test indicator could be used to check the increments of lift, by fixing it on the cross slide, with the plunger in contact with a fixed abutment on the saddle, or *vice versa*.

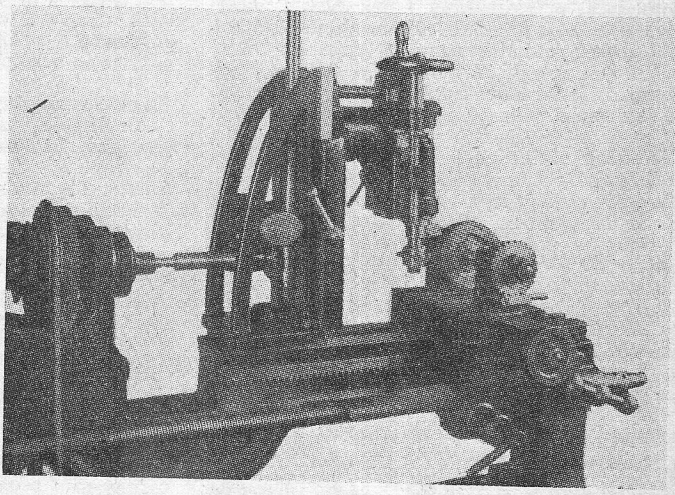
Although not specifically mentioned by Mr. Chaddock, this method might be simply adapted to the production of cams or other profiles by a copying process. The master cam or template would have to be mounted concentrically with the blank (as by mounting both on a true-running mandrel), and a flat-faced contact follower mounted on the cross slide. If the diameter of the copy is required to be exactly the same as the "master," it would be necessary to ensure that the distance of the follower from the lathe axis is exactly the same as that of the cutter point. Another necessary factor in producing an accurate copy is that the follower should be exactly the same shape on its face as the surface which would normally be produced by the cutter on stationary work, which in this case is flat.

Should this method ever be used in conjunction with a cutter having its axis parallel to that of the work, i.e., cutting on the periphery, it would be necessary to use a follower in the form of a disc or arc of the same radius as that of the cutter. Unless these precautions are observed, small but possibly important discrepancies may be introduced in the accuracy of the copy.

With this method, exact accuracy in the indexing of the blank is of no importance; it is only necessary to shift it through a very small angle for each cut, and feed the cutter in until the follower makes contact with the master profile. It is even possible to arrange to keep the lathe mandrel in constant rotation at a very slow rate, and use a spring to keep the cross slide pressed inwards to bring the follower in contact with the master profile; the lead screw of the slide being, of course, temporarily disconnected. Exactly the same methods, by the way, can be used for cam or profile grinding in the lathe.

Vertical Milling Attachments

It has already been seen that the ordinary milling spindle can be used at various angles, including both horizontal and vertical positions. Some forms of grinding attachments, however, have been designed for use mainly or exclusively in the vertical position, their object being to convert the lathe practically into a light vertical mill. One of the best-known of these devices was produced some 20 years ago, and known as the "Abwood" milling attachment. It embodied a rigid vertical bracket adapted to bolt on the



The "Abwood" vertical milling attachment

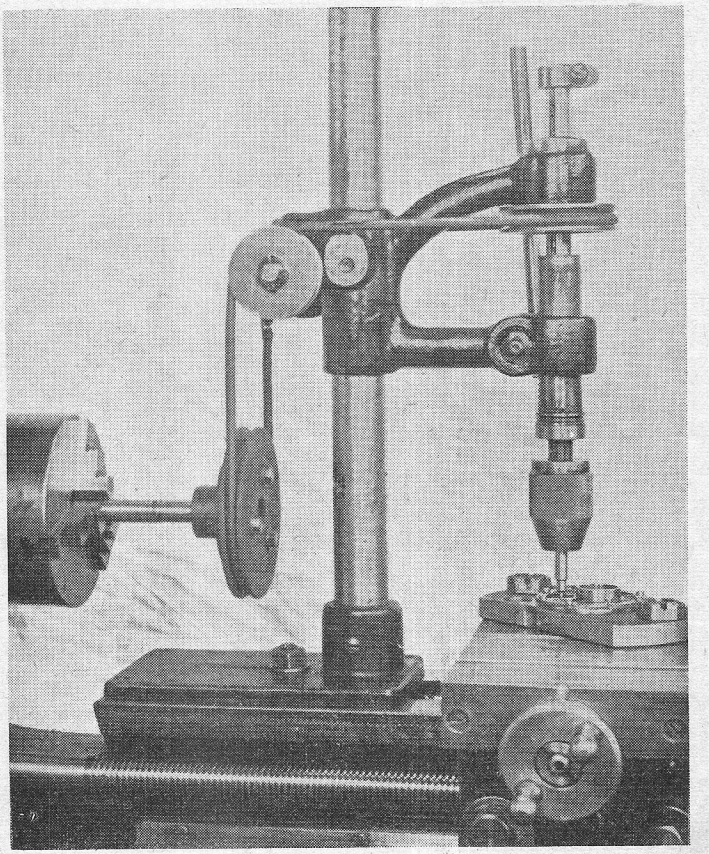
lathe bed, in front of the headstock, and carrying a milling spindle on a slide which provided vertical adjustment. The drive to the spindle was taken, through bevel gears and a vertical shaft, from the lathe mandrel, so that a full range of speeds and ample power was available at the cutter spindle. While this device was undoubtedly sound in principle, and of great utility, it was apparently too elaborate and expensive for most users of small lathes, and, so far as can be gathered, did not attain any great popularity.

Another vertical milling attachment was made about the same time by the manufacturers of the once well-known Relmac lathe, and known as the "Relmil." In this case the milling spindle was carried on a round steel column mounted vertically at the back of the lathe bed, so that the lathe could be used for normal work with the attachment in position, and it could be brought into action on work mounted between the lathe centres, though in this case, its utility was limited by the lack of horizontal feed movements. A vertical slide was provided for the cutter spindle, which had a sliding key in the drive from the pulley, working at a fixed height in its own bearings, and driven from a special countershaft running along the back of the lathe. In this case also, no very great degree of popularity seems to have been attained by the appliance.

A somewhat similar arrangement to that of the Abwood attachment can be produced by mounting a small drilling machine on the bed of the lathe, and driving it, through the usual jockey pulleys, from a pulley held in the lathe chuck. The example illustrated was used by Mr. D. H. Chaddock to deal with a special milling problem, for which purpose it was entirely successful. A machine of the "quill" spindle type is best suited for this work, and the bearings must be really well fitted; some means of clamping the vertical adjustment is also essential. It would be very desirable to have some provision for fine adjustment, as by means of screw feed, but this is rarely fitted to small drilling machines of the type likely to be applicable. As a matter of fact, the usual small drilling machine spindle is not designed to deal with heavy side thrusts as encountered in milling, and for serious work of this nature, it would be best to design a special spindle, with bearings more suited to the purpose, and preferably socketed to take taper-shank cutters or collet chucks.

Stencil Milling

The particular operation for which this set-up was used by Mr. Chaddock was the milling of end-plates for a rotary blower, in which ribs were formed by milling away the major part of the surface, in other words, an "intaglio" process. To facilitate this work, the cutter was guided by means of a steel "stencil plate," having openings corresponding to the shape of the cut-away portion of the end-plate, to which it was bolted in the appropriate position. The form of cutter used was a two-bladed end mill, having cutting teeth formed only close to the end, so that when fed in to the correct depth, the portion of the cutter shank level with the guide plate acts simply as a locating pin or roller, limiting the traverse of the work by coming in contact with the plate, and enabling the contour of the latter to be followed without risk of error or over-run. For work of this nature it is advisable to have the work free to move in any direction, but at the same time fully under control, so that



Small drilling machine adapted for use as a vertical milling spindle, by Mr. D. H. Chaddock

it may either be clamped to a base large enough for comfortable handling, which is laid on the cross slide without bolting down, or it may be clamped to the cross slide, and the lead screw of the latter removed.

The use of a stencil, template or guide-plate has become very popular in recent years for "routing" operations in the softer metals, using high-speed cutters, and it has been found to be one of the most expeditious methods of cutting out complicated shapes in light alloy, wood or plastics, to a high degree of accuracy and finish.

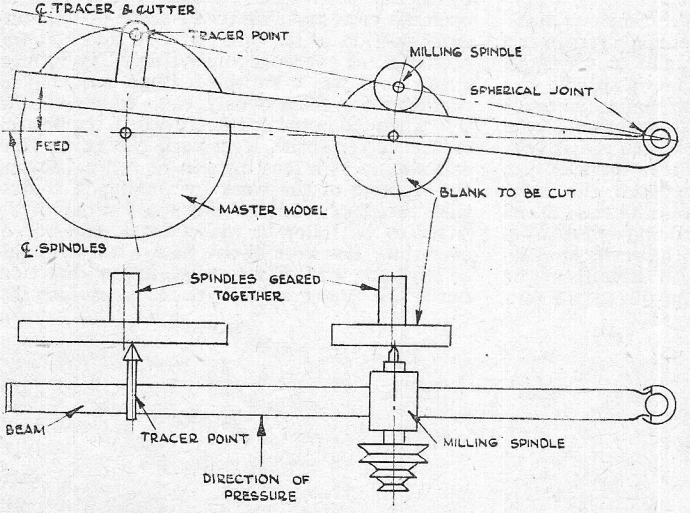


Fig. 39. Diagram showing the working principle of the medallion lathe

There are many other possibilities in the use of simple milling spindles on the lathe or other machine tools. They have been used with special feed or control devices for producing accurate two-dimensional or three-dimensional forms in die-sinking and other tool making operations. The well-known type of engraving machines which have now become almost indispensable in many departments of engineering practice, and are every day finding new applications, are simply high-speed milling spindles, with control by means of a pantograph, which enables them to reproduce the outline, and in some cases the relief, of a master profile to any desired scale.

A very interesting application of the reduced-scale copying principle is found in the medallion lathe, which is used for copying coins, medals, plaques and other low-relief sculptures on a reduced scale (Fig. 39). It comprises two headstocks with spindles and faceplates geared together to rotate at the same speed, and in the same direction. One of these carries the model or "master" and the other the blank to be engraved. At right angles to the axis of the spindles is arranged a rigid beam or lever, articulated to pivot in both the vertical and horizontal planes, by means of a spherical or double knuckle joint. On this is mounted a stylus or tracer point to make contact with the master, and a milling spindle with an end or point cutter to operate on the blank. The distances of the spindle and the stylus from the pivot must be in the ratio of scale reduction, i.e., for copying to one-eighth scale, the distance of the stylus from the pivot of the beam must be eight times that of the cutter point. The beam is pressed towards the master faceplate by means of a weight or spring, and with the spindles slowly rotating, it is swung gradually in the other plane to feed the stylus and cutter from the outer edge of their respective working circles to the centre. In this way the entire surface of the profile on the master plate is covered, and the form of the master is reproduced to scale on the blank. This method is used not only for direct copying of large models in comparatively soft metals, but also making dies in tool steel, from which coins, etc., are produced by stamping. The principles of this machine could be adapted to milling in the lathe.

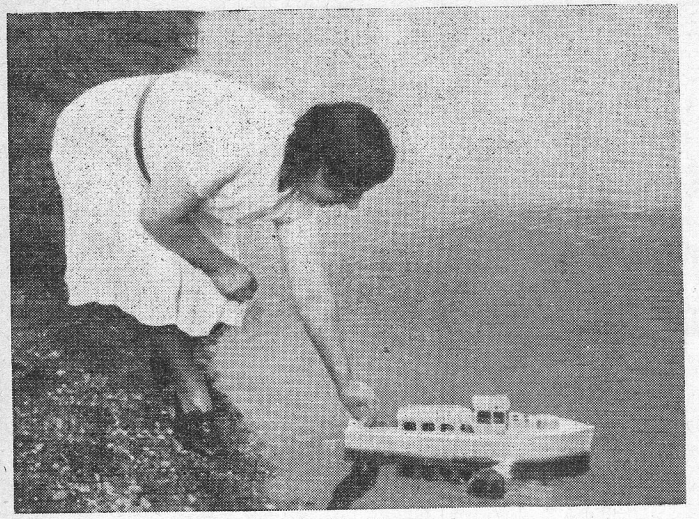
Many ingenious applications of milling spindles were employed by the users of ornamental turning lathes, for such purposes as ornamenting wood or metal objects by the process known as "engine turning." This consisted in the turning of eccentric circles around the face or periphery of the work, indexing the latter to produce interlacing or overlapping geometric figures. An extraordinary amount of care, patience and ingenuity was devoted to this work, which largely has died out, except for examples which are perpetuated by the Worshipful Company of Turners, and exhibited at their exhibitions.

An application of the rotary spindle to what may be termed "Planetary" milling is not without interest, both from the ornamental and utility aspects. It consists in mounting a milling spindle eccentrically on the lathe faceplate, either parallel to the lathe axis, or at any other angle, and indexing it around the lathe axis either to produce geometric forms, or simply to provide a height adjustment to the milling cutter.

(To be continued)

Tube-bending Filler

We have received a leaflet from which it seems that melted lead or solder as a filler, prior to bending a tube, has been superseded by a low-temperature alloy known as "Fry's Tube Bending Alloy." This substance melts in hot water, its melting-point being as low as 70 deg. C. (158 deg. F.). It is more expensive than ordinary tin-lead solder, but it has the advantage that it can be used over and over again. It is described on page 4 of Technical Leaflet No. 4, issued by Fry's Metal Foundries Ltd., Tandem Works, Merton Abbey, London, S.W.19.



The model on her first trials

A Model River Gunboat

By G. A. Walter

THIS is a simple model that was constructed, in a very short time early in 1940, as a birthday present for a young enthusiast.

When sorting through tools and other treasures on returning to civilian life early this year, the author came across the sketches and photographs shown here, which may be of interest to other readers with young nephews.

The prototype was a 42-ft. flat-bottomed river gunboat supplied to the Yugo-Slav Government about 1937. It was driven by Hotchkiss cone propellers, had a draught of only 14 in., and a speed of over 10 knots.

The breadth and draught of the model was increased slightly beyond scale dimensions, but the general outline closely follows the prototype.

The hull was cut in one piece from 26-s.w.g. tinplate, folded, and then soldered.

Superstructure and decks were made from the same material, all openings being edged with 18-s.w.g. brass wire.

The wheelhouse roof, saloon roof, engine room cover and gun turret were all made removable to give access to the power plant.

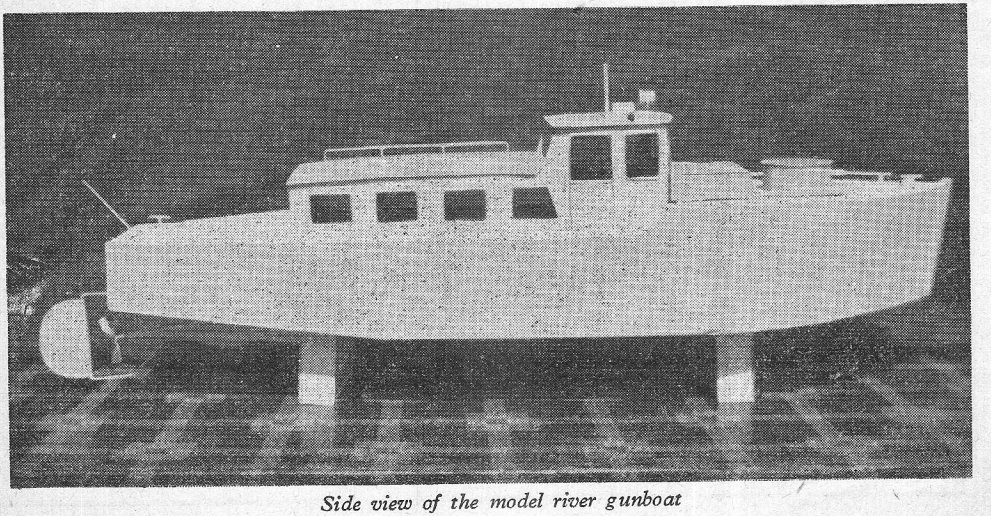
Deck fittings are of a very simple nature and need no description.

The engine was a small oscillating job standardised by Bonds o' Euston Rd., and, with the boiler as described, developed ample power to drive the model at an impressive speed.

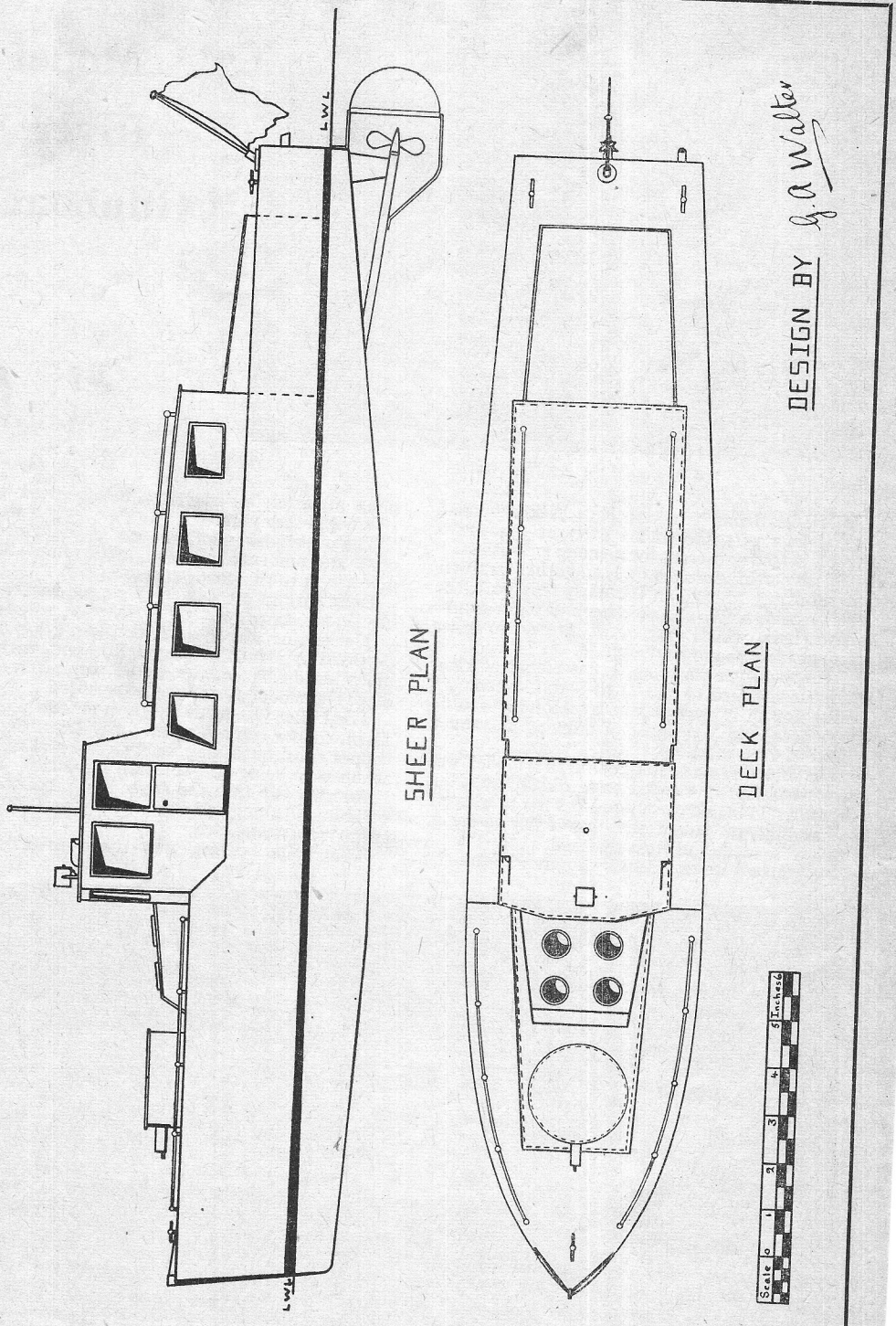
The boiler was made up from an odd piece of $1\frac{1}{2}$-in. copper tubing, $5\frac{1}{2}$ in. long. The 16-gauge copper ends, brass stay, safety-valve seating, and steam pipe being soft-soldered in place.

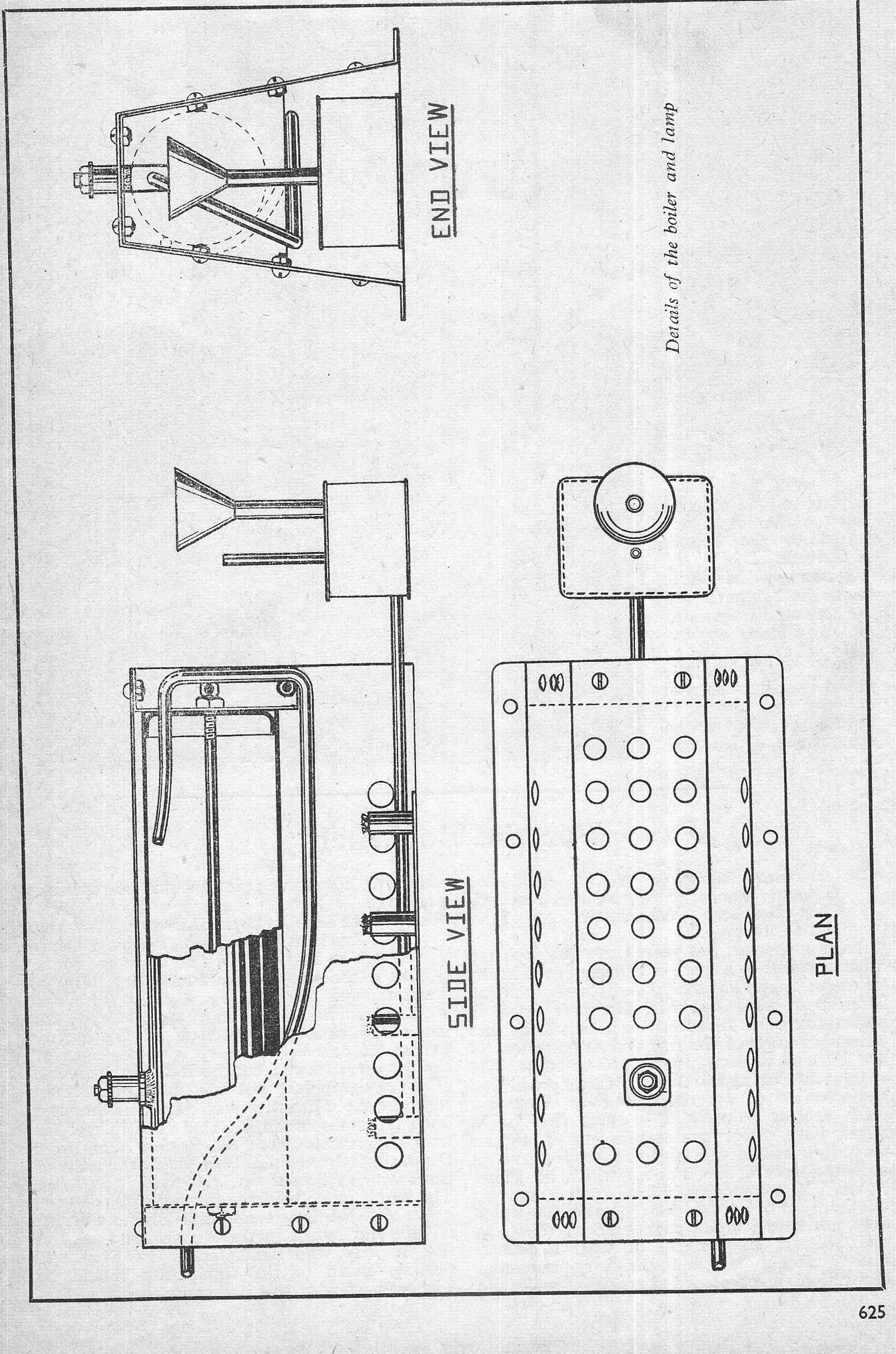
Another dip into the scrap box produced the odd bits of tubing and brass with which the spirit lamp was constructed.

The boiler casing was made of 22-gauge

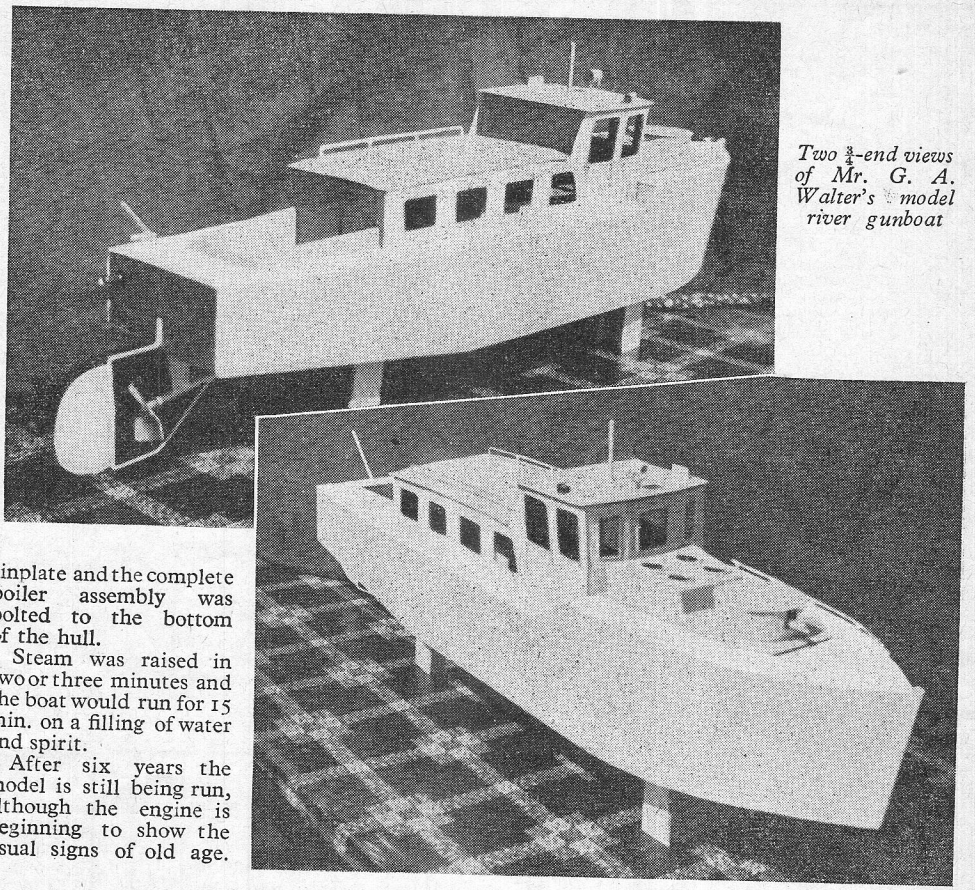


Side view of the model river gunboat


L.W.L.
L.W.L.
SHEER PLAN
DECK PLAN
DESIGN BY G. A. Walker
Scale 0 1 2 3 4 5 Inches



Details of the boiler and lamp



Two ¾-end views of Mr. G. A. Walter's model river gunboat

tinplate and the complete boiler assembly was bolted to the bottom of the hull.

Steam was raised in two or three minutes and the boat would run for 15 min. on a filling of water and spirit.

After six years the model is still being run, although the engine is beginning to show the usual signs of old age.

For the Bookshelf

The Furness Railway, by W. McGowan Gradon. (Published by the author at 333, Corn Exchange, Manchester 4.) Price 15s. 6d. by post.

During the past few years there has appeared what amounts to a spate of railway books, many of them mere handbooks of scarcely lasting interest or use. But Mr. Gradon's book is something quite different; it is a worthy and valuable record of the rise and development of the Furness Railway, from 1846 to 1923. The story is interesting and treated in great detail, and the selection of material must have involved a great deal of painstaking research that would never have been undertaken except by an enthusiast whose sole object is to preserve an authentic record of a railway which no longer exists. The locomotives receive great attention; but there can be hardly a feature on the line which does not have its due consideration. Frankly, this book is an example of what a railway history should be, and the very numerous illustrations, maps, plans and gradient profiles add much to its value; it should be carefully preserved.

War On the Line, by Bernard Darwin. (London: The Southern Railway Co., Publicity Dept., Waterloo Station, S.E.1). Price 7s. 6d.

This is the story of the Southern Railway in wartime, and an inspiring story it is! Well written and in a light, easy style, despite the inevitable grimness of much of it. To a great extent, of course, the story is common to all the British railways; but the Southern, by reason of its geographical position, bore the largest share of the difficulties war conditions imposed upon rail transport in Britain. The tale begins with the evacuation of the British Army from Dunkirk, and continues through all the arduous times which followed until the end of hostilities. The heroic exploits of the railway staffs and the crews of the railway steamships all find a fitting tribute and record in these pages, and we feel that nobody who understands just what our railways mean to the community should be without a copy of this engrossing book.

Clubs

Plymouth and District Society of Model and Experimental Engineers

A meeting was held at Marlborough House, Plymouth, on Tuesday, November 19th, 1946.

Future activities were discussed, and it was decided to hold an exhibition in the spring of 1947, provided suitable accommodation could be located. The exhibition would be non-competitive, and exhibits would be invited from other societies in the South-West.

The locomotive, and the boat-building sections held their first meetings, and decided on various suggestions for future activities.

The next meeting of members will be held on December 20th, at The Athenaeum, Alexandra Road, when the subject will be "The Internal Combustion Engine." New members will be welcome.

The Hon. Secretary is J. W. MOYSE, 3, Evelyn Place, Plymouth.

Peterborough and District Model Engineering Society

An interesting visit was made on November 17th, to the L.N.E.R. locomotive sheds, the party being escorted by the superintendent to whom the society's thanks are due.

The annual exhibition has been fixed for February 27th and 28th, and March 1st, at St. Marks Hall, Cromwell Road.

Hon. Secretary: JOHN H. HURST, "West Rays," Lincoln Road, Werrington, Peterborough.

Tees-side Society of Model Engineers

Meetings are held on alternate Tuesdays, at 7.0 p.m., in the Temperance Institute, Woodlands Road.

The annual general meeting, for the election of officers, will be held on January 7th.

Secretary, *pro tem*: VINCENT BYRON, 2, Church Street, Middlesbrough.

Lincoln Model Engineering Society

Since holding our meeting for re-constituting the club on more formal lines, we have been able to offer more attractions, as witness the following items:—Parties of members have paid visits to exhibitions by the Leicester, Scunthorpe and Grimsby Model Engineering Societies. A welcome return visit on November 6th was made by Mr. R. H. R. Garraway, locomotive superintendent, L.N.E.R., Lincoln, who gave a most interesting lecture showing the operation of the "Froelich Brake" in the up-yard at Whitemoor Marsh, illustrated by films taken by the lecturer, and various other films of interest to locomotive fans.

Another interesting talk was given on December 4th, by Mr. D. Yarnall, member, on "Steam Valve Gear."

It is hoped to arrange an instructive lecture early in the New Year on "Gear-Cutting Made Simple for the Model Engineer," by Mr. J. Rodway (member). We hope to launch the first post-war exhibition early in the new year. The club's multi-gauge track in Boultham Park is progressing slowly; there have been laid foundations for concrete arches for the first 100 feet, and several of the arches have also been cast. Wet weather has held up much of the work, but the greatest hold-up has been the lack of volunteers for the work, and the secretary would be pleased to hear from members willing to form a rota of working-parties for this, in an endeavour to complete the track by the spring, for the testing of the many locomotives now nearing completion; also for the interest and amusement of the children in the Park, and to show the Corporation that we mean business, considering that they have been good enough to give us such a splendid site.

Hon. Secretary: G. T. SINDALL, 53, Geneva Avenue, Lincoln.

Glasgow Society of Model Engineers

The next meeting will be held within the Society's Rooms, at 60, Clarendon Street, Glasgow, N.W., on Saturday, December 21st, 1946, at 7.30 p.m.

It will take the form of a "Model Steamer Night," and be addressed by four speakers, each describing their vessels, and the details connected therewith. Much interest has been evoked this year by a revival in this class of model work, which should be further augmented by such vessels on show.

Visitors will be welcomed and particulars of membership can be had from the address below.

Secretary: JOHN W. SMITH, 785, Dumbarton Road, Glasgow, W.1.

Victoria Model Steamboat Club

The annual general meeting was held on December 1st. During the proceedings, the hon. secretary, chairman and treasurer were re-elected for a further period.

New members will be welcome, and may be enrolled either at the Boathouse, Victoria Park, E.9, every Sunday morning, or by communication with the Hon. Secretary: J. B. SKINGLEY, 238, Colney Hatch Lane, Muswell Hill, N.10.

The North London Ship Model Society

The Society has now obtained the use of a club room at the Union Chapel Club House, 19, Compton Terrace, Highbury, N.1, and a cordial invitation is extended to all ship lovers to the meetings, which are held on the first Friday in each month at 7.30 p.m. Full particulars of membership may be obtained from the Hon. Sec., M. E. MOON, 53, Freegrove Road, Holloway, N.7.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects, which should be addressed to him at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall and Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer" 23, Great Queen Street, London, W.C.2.

"THE MODEL ENGINEER"
SALES AND WANTS

Private: **Threepence** *word.* *Trade*: **Sixpence** *word.* *Use of Box* **2/6** *extra.*
Minimum charge, **3/-**.

TOOLS & WORKSHOP

Buck and Ryan's Department for Lathes, Drilling Machines, Grinders, Electric Tools, Chucks, Surface Plates, Lathe Accessories and Tools.—310-312, Euston Road, London, N.W.1. Telephone: EUSton 4661. Hours of Business: 8.30 to 5.0 p.m., Monday to Friday; Saturday, 1.0 p.m.

Split Chucks for Watchmakers' Lathes, 6 mm., 6½ mm., and 8 mm., at 7s. each, postage 6d.—JOHN MORRIS, 64, Clerkenwell Road, London, E.C.1.

Infinitely Variable Speed Gear, ratio 16 : 1, material supplied, leaflets.—CROWTHER, 85, Charlotte St., Rochdale.

"Little John" Lathes. Sole Selling Agents for Home and Export. Send for illustrated literature and orders to—THE ACORN MACHINE TOOL CO. (1936) LTD., 610/614, High Road, Chiswick, London, W.4. Telephone CHIswick 3416-7-8-9.

Wanted, "South Bend" Bench Lathe, "Model A." Your price paid. Also MODEL ENGINEER, Vol. 79, unbound.—WEBB, 9, Roberts Road, Acock's Green, Birmingham 27.

As One Lot Only. Fixtures, tools for making "O" gauge steam engines, including 50 sets of parts (20 assembled, tested, and running apart from superstructure). These engines are readily sold at £7 each. £150 no offers.—37, Links Road, West Wickham, Kent. Spring Park 4278.

"Magister" Patent Swiss Millimetre reading Micrometer, in original plush lined case. Chromium frame, Pocket stop and Locking ring. Lapped barrel gives range 0-25 mm., 25-50 mm., 50-75 mm., 75-100 mm., 100-125 mm., in five positive locked positions. Practically unused, it represents a unique acquisition to any model engineer who appreciates real precision. Price, Eleven Guineas.—Box No. 4241, MODEL ENGINEER Offices.

3½" Myford Lathe on motorised stand nearly new, £49; 2" Pultra Precision Lathe, as new, draw in collets, countershaft and motor, £65; Electric Tool-post Grinder £6 10s.; Pathe 200B 9.5 Projector, £30.—MILLS RADIO, Northfield, Birmingham.

Stuart Turner B.B. Steam Engine, vertical, new condition, £3 10s.—Rose Cottage, Brothertoft Road, Boston, Lincs.

Lathe 2" centres by 6", four speeds sliding saddle. Price £4. Full particulars.—10, Tennyson Street, Keighley, Yorks.

Lathe, 3" George Adams, B.G.S.C., faceplate and 2 chucks, £12. Evenings after 7. Stamp please.—WAINMAN, 96, Oakfield Road, London, S.E.20.

Wanted, 3" B.G.S.C. Bench Lathe.—TOMLINSON, 90, Sunnylaw Street, Possilpark, Glasgow.

Vertical Steam Engine, Slide valve, ¾" bore, ¾" stroke, £2 10s.—39, Campbell Avenue, Ilford. VAL. 4541.

Wanted, New Small Tools; also good condition used Lathe, Drills, etc.—Chanctonbury, Buckingham Way, Wallington, Surrey.

For Sale, Milling attachment for 3½" lathe, £4 10s.; Vertical swivelling slide, £2; Countershaft with six 7" pulleys and hangers, £2; 100 H.S. Drills, 25s. Will exchange. Wanted, working drawings for 3½" gauge Stroudley "D" class tank, to buy or borrow.—165, Tenniswood Road, Enfield, Middx.

Air Compressors, 2" bore, 2" stroke (approx.), Tyre pumps from heavy lorries, £2 each; two Beresford Stork Fire Pumps, 8 h.p. Austin engines. As new. Offers wanted. Bench drill, hand-enclosed gear, self feed, 2 speed, £6.—TUCK, "Denver," West Wittering, Sussex.

Contents of Privately Owned Workshop for disposal, including precision Machine Tools by Skoda-Drummond and others; also quantity of precision measuring instruments and small tools. Everything being in first class condition, and open to any inspection, which can take place any Saturday afternoon by appointment.—Box No. 4244, MODEL ENGINEER Offices.

Jacobs Pattern (Sphere) Drill Chucks ex stock, 0-¼", 17s. 11d., 0-⅜", 22s. 0d., 0-½", 28s. 0d.; No. 1 Arbors, 3s. 9d.; No. 2, 4s. 6d., carriage extra. All lathe chucks in stock. Myford, Atlas, Adept Spares and Accessories.—TERRY, Fishers Lane, Cold Ash, Newbury.

IMPORTANT

THE "M.E." GOES AHEAD

See "SMOKE RINGS" IN THIS ISSUE

4" Cushman S.C. Chuck, internal, external jaws, as new. Best offer above £5.—HANCOX, 39, Esmond Gardens, Chiswick, W.4.

Myford Production Lathe, complete turret, slides, lever collets, etc., as new, £15; 3½" Wade "Waltham" Lathe, plain, under bench countershaft, £10; Transformer "Donavon," 400-415, 12 V., 25 A., £4.—DOGGETT, 23, Porchester Road, Newbury.

"Myford" Motorised 3½" Lathe, type A2, on stand, with starter, self-contained countershaft, S.C. chuck, superb condition, £60.—55, Forest Hill Road, Sheldon, Birmingham.

Sale, Headstock, 6" centre B.G., £4; slide rest, suit 6", £4; 4-jaw Independent chuck, 8", £3. All good condition and complete. Offers after 5 p.m.—LIDDELL, Highland Terrace, Ferryhill, Durham.

MODELS & FITTINGS

Apex and New Atom Minor (Mr. Westbury's design). Engine castings of DTD 424, the famous alloy as used in Rolls Royce Aero engines, sp. gr. 2.56. Tensile 9 tons, lighter and far stronger than diecast, with most attractive finish. Carburettor castings (described June 14th issue "M.E."), and spiral timing gears for Apex, ball-races, piston rings, miniature plugs, contact and other equipment. Send us your enquiries Trade also invited.—THE HEADINGLEY MOTOR & ENGINEERING CO. LTD., 8, Otley Road, Leeds.

"Lumec" 9.5 Projector, Precision Machine for workshop construction. Particulars 4d.—RACET DESIGNS, 46, Orchard Way, Chesterfield.

For Sale, 2½" gauge 4 cylinder "Gwen Elms" 4-6-4 designed by "L.B.S.C." fitted with twin water pump, hand pump in tender, injector, mechanical lubricator, all fittings, engineer built. Photograph on application, £90.—THOMPSON, 65, New Street, Jersey, C.I.

Injectors, Guaranteed, now available from stock, suitable 2½" to 5" gauges 50s. each; Pressure Gauges, 18s. 6d. each; Mechanical Lubricators, 35s. each; Boiler fittings of any type made to order. Catalogues 9d.—R. M. EVANS & Co., 92, Pimlico Road, London, S.W.1. Official agents for "1066 Products."

David Curwen, Experimental Engineers, Gore Lane, Bardon, Nr. Marlborough, Wilts. Light power steam engines of all types.

For Sale, 2½", 3½", 5" gauge Locomotives, equipment in these and other gauges, steam stationary plants, power ships. Please write requirements and enclose stamp.—Box No. 4231, MODEL ENGINEER Offices.

Various Refrigerator Parts, including Pressure Control Switch 80/185; variable automatic thermostat range—10/+20F. Above up to 400 volts. Expansion valve Methyl Chloride. Offers, all or parts.—Box No. 4229, MODEL ENGINEER Offices.

Wanted, Steam Engine and Safety Boiler suitable for model boat. Size of boat: 3 feet long × 5 inches wide.—TAYLOR, 53, Airthrey Avenue, Glasgow, W.4.

Large Collection Bassett-Lowke and Hornby Model Trains, including "Royal Scot" by Bassett-Lowke, and several other locomotives. Further details on request.—Box No. 4254, MODEL ENGINEER Offices.

Sale, New Stuart vertical 1½" bore, 1¼" stroke. Built by silver medallist, £9 15s. Particulars stamp.—WILLIAMS, "Hillcrest," Old Dashwood Hill, Stokenchurch, High Wycombe, Bucks.

½" Super Marine Engine Castings, 25s.; cylinder bored and crankshaft finished, 7s. 6d. See Oct. 10th advert.—"Marine," 80, Ridgeview Rd., London, N.20.

Two Brand New high speed vertical Steam Engines, ⅝" × ⅝", design as Stuart No. 10, box beds, exhibition fit and finish, £3 15s. each. Approval against cash. New "Seco" flexible shaft drilling machine, £5 10s.; Runbaken Midget Grinder, £4 10s., both 230 v., Universal—HARRISON, Colman's Hill, Peaslake, Guildford, Surrey.

For Sale, "Austere Ada," 2½" gauge, complete, except for cab and trimmings, tender finished, offers.—139, Honeysuckle Road, Southampton.

7¼" Gauge. Complete set of 47 castings with wheels, turned and bored, and cylinders machined, with 8 sheets drawings for Southern 0-6-0 tank, £16.—8, Greenways, Hertford.

Sale, Hornby L.M.S. 4-4-2 clockwork. Offers.—THODY, 20, Rutland Road, Bedford.

Model Maker Required to build models of Kitchens for Exhibition purposes, plans supplied, first class workmanship, amateur considered. Write—Box No. 4250, MODEL ENGINEER Offices.

For Sale, Extensive Clockwork gauge "1" Railway. Over 150 ft. scale track. Won several prizes. What offers over £30?—KEEF, The Cottage, Willingdon, Eastbourne, Sussex.

Sale, Exhibition model triple expansion marine, or exchange back geared 3" screw-cutting lathe, or 1½" scale traction engine. Particulars, stamp.—WEBSTER, Oak House, Shawforth, Rochdale.

2½" Gauge G.W.R. 4-6-0 Locomotive and tender, coal-fired, passenger hauler, Walschaerts valve gear, mechanical and hand operated water pumps, usual cab fittings. First class workmanship, £47 10s., or near offer.—J. BUCKLEY, 23, Beeston Road, Sale, Cheshire.

Petrol and Diesel Engines, 5 c.c., individually built and tested, suitable aircraft, boats, race cars, 7 Gns. and 8 Gns. 21 days delivery.—BARAWITZKA, 10, Lily Avenue, Newcastle-on-Tyne.

For Sale, ¾″ × ¾″ Twin Launch Engine, suitable 6′ 0″ boat, engineer built, perfect, £8.—71, Edenbridge Road, Bush Hill Park, Enfield.

For Sale, Falcon 5 c.c. Petrol Engine, with coil, plug, and prop., £3 10s. Address—BANKS, 11, Benchill Drive, Benchill, Manchester.

For Sale, Miniature Railway, 2½″ gauge. Outdoor track over 200 yds. with multiple points, crossovers, bridges signal boxes, station and goods yards engine houses, turntable, coaling shed and water tank. Took 20 years to build, complete with wagons, goods vans, and Pullman coaches, correct to scale ½″ to 1 ft. Engines coal-fired and steam pressure 70 lb., approx. speed 15 m.p.h. New owner to remove same. Offers over £200.—Box No. 4240, MODEL ENGINEER Offices.

Stock, Wellworthy piston rings, 1″, 2s.; 1¼″, 2s. 3d. each; Lodge plugs, ¼″ and ⅜″ threads, 5s. each.—HASELGROVE, 1, Queensway, Petts Wood, Kent.

Ideal Presents, Multitubilar Copper Vertical Boiler, 12″ × 6½″, £10; another centre flue, 9½″ × 4½″, £5. Both brand new. Stamped addressed envelope for details and list.—WEMBLEY MODELS, 6, Park Road, Wembley.

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Electradix Bargains include:—

D.C. Table Fans, 110 and 220 volts, by G.E.C., Verity and other leading makers; 12″ blade and guard, 45s. each; Oscillating type, 55s.; Fan Motor only, 110 and 220 volts, large bulkhead type, 35s.; large 110 or 220 volt 16″ Table. Fans for workshop use, 55s.—Below.

Transformers for soil heating and small welding jobs, 250/300 watts, 230 volts, A.C., enclosed in metal case, 75s.—Below.

Blowers, 12 volt D.C., for valve cooling or lab. work, £3 10s.; 32 volt D.C. Motor Blowers, ¼ h.p. Motor with output of 500 cu. ft. per minute, £8 10s. —Below.

Bells, Outdoor, Ironclad Tangent for works or schools, 230 volts A.C., 6″ gong, 42s.; Indoor House Bells, 5s. 9d.; Bell Transformers, 3-5-8 volts, 7s. 6d.; Bell Wire, 15s. per 100 yds.—ELECTRADIX, 214, Queenstown Road, London, S.W.8.

Power Transformers, 170 va, oil filled, input 250 volt, single phase, 50 cycles, 8 output tappings, 230 volt, 1.17 amp., 230 volt, 1.10 amp., 230 volt, 1.03 amp., 230 volt, 0.93 amp., also 16.5 volt, 15.5 volt, 14.5 volt, 13.5 volt at 15.1 amps., £3 10s., including carriage.—Below.

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